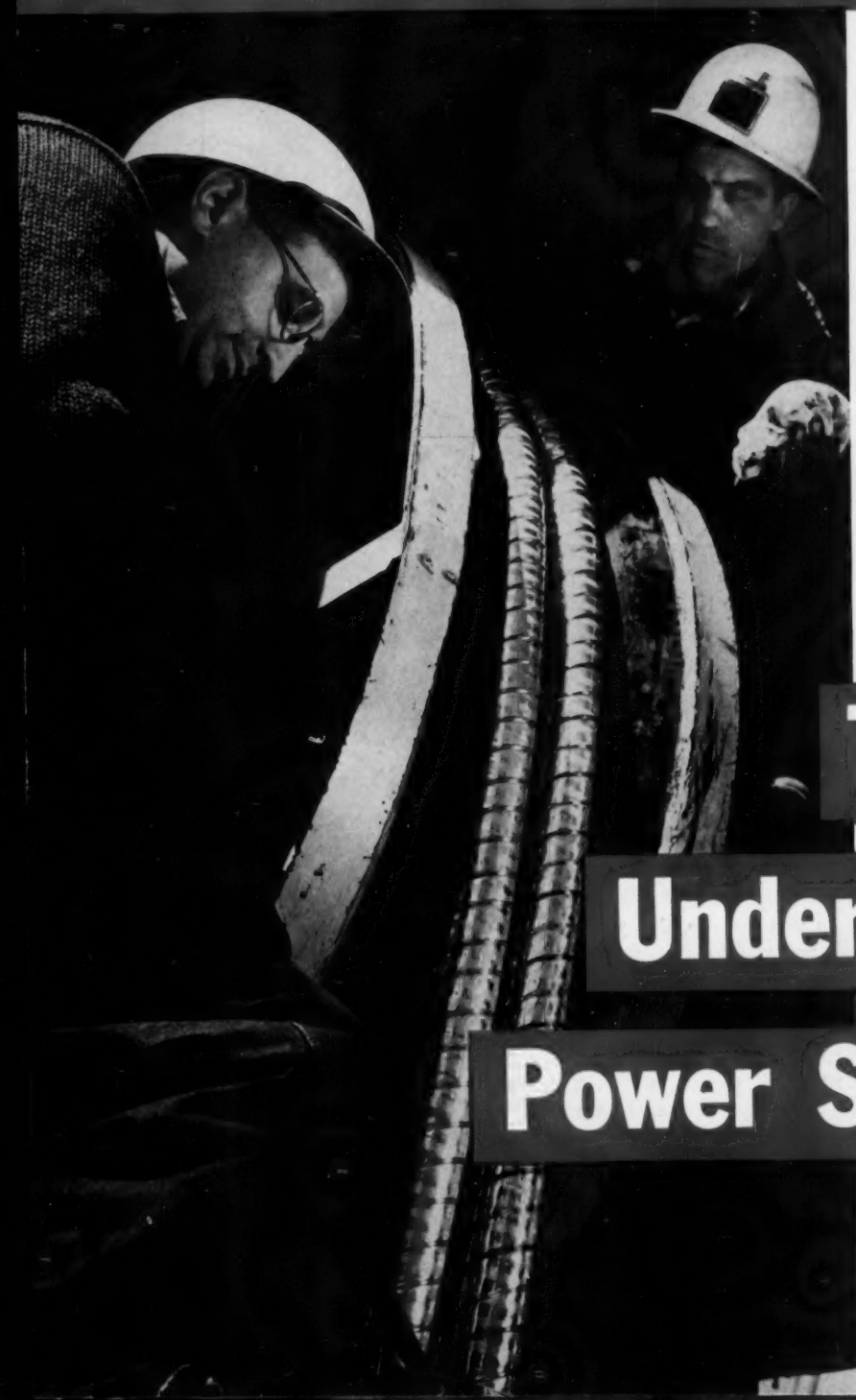
The Electrical Industry's Weekly Magazine

August 5, 1957

Electrical World

Price 50 Cents

A McGraw-Hill Publication



New EEI Book is Basic Reference for . . .

Today's Underground Power Systems

Page 52

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UNIVERSITY MICROFILMS IN
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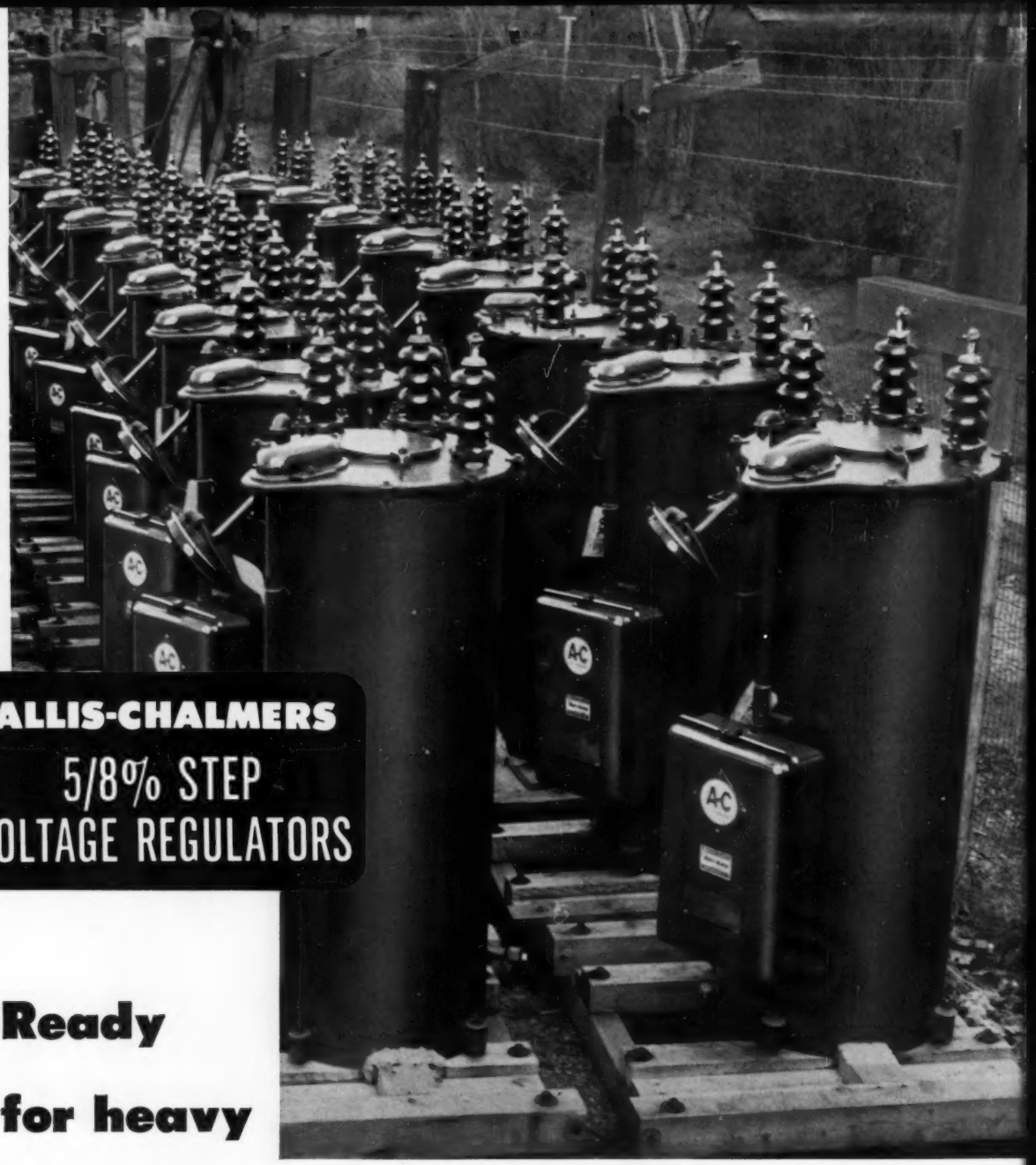
ANN ARBOR MICH



ALLIS-CHALMERS

5/8% STEP VOLTAGE REGULATORS

Ready for heavy summer loads!

As you can see, this power company is prepared for increased summer load requirements caused by irrigation, air conditioning and other cooling equipment. By now these Allis-Chalmers regulators are probably in service ready to correct low voltage conditions, prevent revenue losses and customer complaints.

An important feature of these regulators is *Vari-Amp*. With *Vari-Amp*, range of regulation can be reduced . . . current carrying capacity increased as much as 60% without changing either the regulator or the wire size.

Field Stocks

Field stocks of Allis-Chalmers regulators provide fast delivery to meet special requirements. For complete information, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-5454

Electrical World

Vol. 148, No. 6 August 5, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Features

CURRENE EVENTS

Here's Alternative to "Non-Callable" Clauses

Companies might share gains on bond redemptions with bondholders if demand for "non-callables" persists.....p 46

Adopt New Strategy in Woodpecker War

Research at Pennsylvania State University uncovers effective weapons to defend poles from destructive birds.....p 48

FULL-LENGTH BOOK REPORT

Today's Underground Power Systems

New EEI book provides a basic reference and guide to design, construction, operation, and maintenance.....p 53

METERING

Ultrasonics Speed Meter Register Cleaning

Long Island Lighting does the job in 3 minutes at a total cost of $1.37. Method may lead to automation.....p 56

PROTECTION

Current Transformers Match Breaker Ratings

Consistent matching is achieved when CT's mechanical symmetrical rating is 60.3% of breaker's rms rating.....p 60

DISTRIBUTION

Take a Bold Look at Distribution

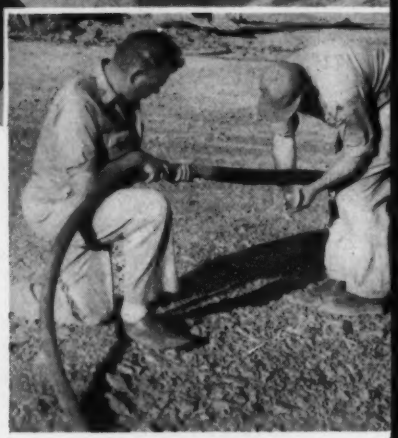
For growing loads in existing homes and much higher ones in future homes today's practices must be revised.....p 62

Departments

Atomic Progress 43
Editorials 41
• Electrical Newsletter 19
Engineering Trends 22
From the Publisher 5
Industrial Applications 80
How To 66
Heating and Cooling 76
• Management Newsletter 99
Manufacturers and Markets 104
Meetings Calendar 111
New Equipment 83
News About People 108
News-Beat 50
Readers Forum 112
Selling 72
Washington Wire 42

INDEX TO ADVERTISERS.....117

service drop



portable cables

New Self-Fusing, All-Weather SPLICING TAPE scores solid hit

At last! . . . an all-weather, self-fusing, flame-resistant splicing tape is on the market. This new, multi-purpose tape is already generating wide acceptance . . . the only self-fusing tape listed by the Underwriters' Laboratories for use as "sole insulation and covering of splices and joints in electrical conductors."

OKOWELD rapidly fuses into a solid, weather-resistant wall. It serves as *both* insulation and sheath on cables for operation up to 2000 volts . . . cannot unwrap or separate into layers like "adhesive" tapes.

Electrically strong, **OKOWELD** has excellent resistance to water, weather, ozone, chemicals, oils and most hydrocarbons.

OKOWELD's toughness makes it ideal for portable cables on rugged jobs . . . and it passes the Bureau of Mines Flame Resistance Test.

OKOWELD is easy to apply . . . either side is "up" . . . shapes smoothly over irregular surfaces . . . use in coldest weather.

Non-sticky, non-brittle, using no adhesives, **OKOWELD** is the "thousand-uses" splicing tape that never sits in the electrician's tool box waiting for a job. Ask your distributor for full facts today or write to The Okonite Company, Passaic, N. J.

phase color coding

Sold only through authorized distributors

OKONITE SPLICING TAPES

5265

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. . . from the publisher

"Experts in Our Field"

Everytime I watch one of these TV quiz shows where a shoemaker is winning thousands of dollars because of his knowledge of opera or a small boy because of his knowledge of the stock market, I am reminded of our younger staff members.

These TV contestants are experts in their chosen fields because undoubtedly they have spent thousands of hours reading and studying on that one subject. In much the same way Electrical World builds its younger editors into experts. They spend all of their working and many of their off-duty hours reading about the electric utility industry, writing about it, talking about it. They go to industry meetings. They talk to industry leaders. They "live" the industry.

Now to say that these young editors are experts in the same sense that a designer of a supercritical pressure unit or 345-kv transmission line is would be ridiculous. Yet they are experts in our field of electric utility information. Experience etches into their memories an encyclopedia of industry happenings, progress, statistics, and developments. By drawing on this knowledge they can interpret industry news for you.

Fischer Black

ELECTRICAL WORLD

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Postmaster . . . Please send form 3579 to Electrical World, 330 W. 42nd St., New York 36, N. Y.

he can switch your 12 kv feeders anywhere, any time, under any load with a hook stick using an S&C LOAD INTERRUPTER

The stick-operated S&C Alduti Load Interrupter in use

Sure! The switching of your 12 kv distribution feeders is getting tougher and tougher! Maybe your linemen are living with it, or maybe you are spending a fortune just to get by.

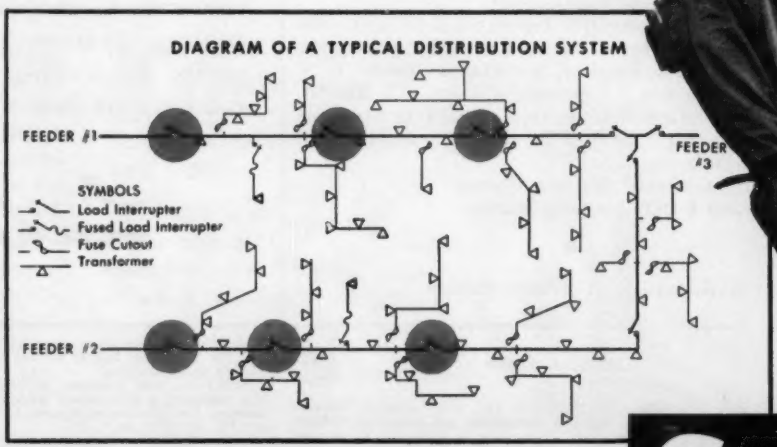
Is there another alternative?

Certainly! A stick-operated S&C Load Interrupter. It can switch positively—under any condition—any load, whether it's line charging current, capacitor charging current, magnetizing current, or full load. And it can be done without the hazards and uncertainties of an external arc. Here's a switch that will keep your linemen happy, and the comptroller, too.

USE IT AT SECTIONALIZING POINTS

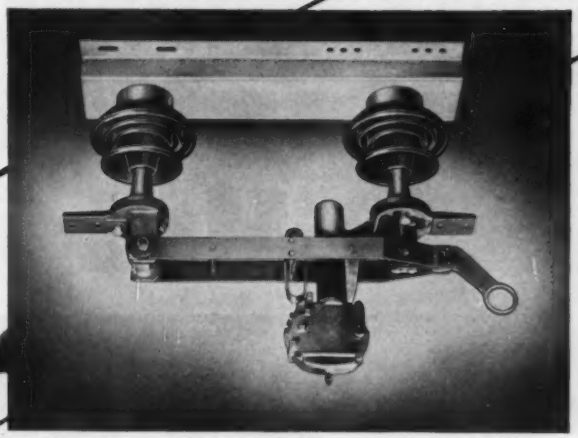
On 12 kv *radial* circuits, increased loads have made switching at sectionalizing points virtually impossible with conventional disconnects. On *loop* circuits (right) it's difficult enough where the duty involves only switching in parallel. And if the tie switches are open, hazard-free circuit interruption can be an impossibility.

Here, S&C Load Interrupters will give you safe, positive, circuit interruption on full line voltage and full load current—an advantage under emergency conditions, and a convenience under normal circumstances.



Specialists in High-Voltage Circuit Interruption since 1910

S&C



The S&C Load Interrupter, Alduti type; outdoor, single pole, (stick-operated); 14.4 kv, 600 amp. Three-pole, group-operated load interrupters are also available.

Load Interrupter Performance Comparison

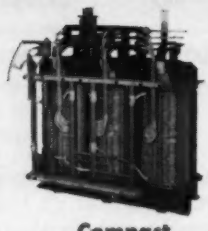
PERFORMANCE	S&C Load Interrupters		Conventional Disconnects	
	Stick-Operated	Group-Operated	Stick-Operated	Group-Operated
Interrupt current from parallel sources safely?	YES	YES	DOUBTFUL	DOUBTFUL
Safe to equipment or personnel if inadvertently opened on full voltage (in case loop is open)?	YES	YES	NO	DOUBTFUL
Dump load without opening feeder breaker, or without preliminary unloading?	YES	YES	NO	DOUBTFUL
Multi-pole device controllable from ground (may be required by system practice or other circuits on same pole)?	NO	YES	NO	YES
Interrupt line charging current safely?	YES	YES	NO	DOUBTFUL
Cost?	LOW	HIGHEST	LOWEST	HIGH

The S&C Load Interrupter can switch the circuit without unloading preliminaries and without opening the breakers. The use of S&C Load Interrupters cannot lead to dangerous phase-to-phase or phase-to-ground faults, because there is NO EXTERNAL ARC. Also there is no danger to men or equipment in case of inadvertent operation. The S&C Load Interrupter breaks all load and charging currents instantly and decisively. Besides, you can mount it in any desired position —vertical, upright, or inverted. Write today for Catalog Section 760 on S&C Load Interrupters.

LOAD INTERRUPTERS

S&C ELECTRIC COMPANY

Helping

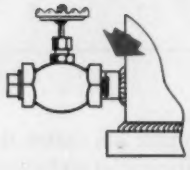


Compact, low-loss design

Thermal capacities are high for contingency load conditions. Sturdy, time-proved core and coil construction adequately meets repeated short-circuit stresses of network operation.

Safe, dependable tap-changing mechanism

Handle inserted through two-inch opening in cover operates mechanism. Handle cannot be removed unless the tap changer is in a positive position.



Threaded valve connections

Connections are solder wiped for extra protection. Valves located for easy access. Globe-type valves with non-rotating seats close tight, avoid wear on valve seats.

Special design of bushing seal

Spiral-wound metallic gaskets actually adjust to changing operating conditions. Gaskets can be installed without grease or cement. May be re-used if necessary.

Flexibility in Choice—To simplify application problems, Allis-Chalmers network transformers are available in all three types — oil filled, *Chlorextol* liquid filled, and sealed dry type.

ALLIS-

Meeting Growing System Needs
...in city after city

Newark Grow!

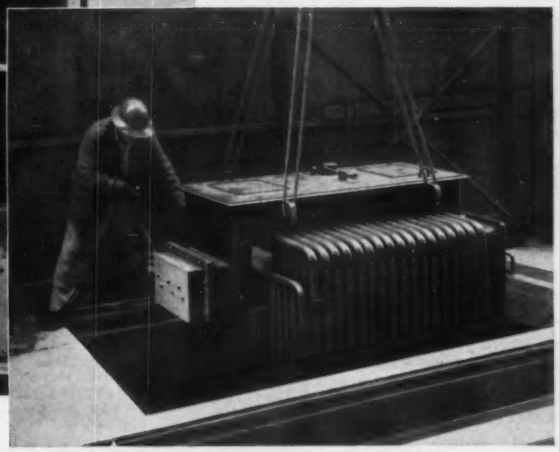
Symbolizing a wholesome optimism, reflected throughout America, is the new cloud-nudging Mutual Benefit Life Insurance Building in progressive Newark, N. J. Along with Newark's healthy growth came the inevitable load concentration growing pains—a condition that has been aided by the installation of two Allis-Chalmers 2000-kva network transformers.

Linked into the *Public Service Electric and Gas Company's* network system, these Allis-Chalmers units are helping to meet increased load demands of power, lighting and air conditioning. Compact design, rugged construction, conveniently located accessories, high thermal capacities, protection against corrosion and flooding — these features make A-C units the logical choice.

Two Million Kva in Operation

This installation has pushed Allis-Chalmers operating kva near the two million mark. When you consider your next network installation, it will pay you to investigate the reasons why Allis-Chalmers transformers are high on the preference list of utilities everywhere. Get all the facts. Call your nearby A-C district office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Chlorextol is an Allis-Chalmers trademark.



CHALMERS

A-C ALLIS-CHALMERS

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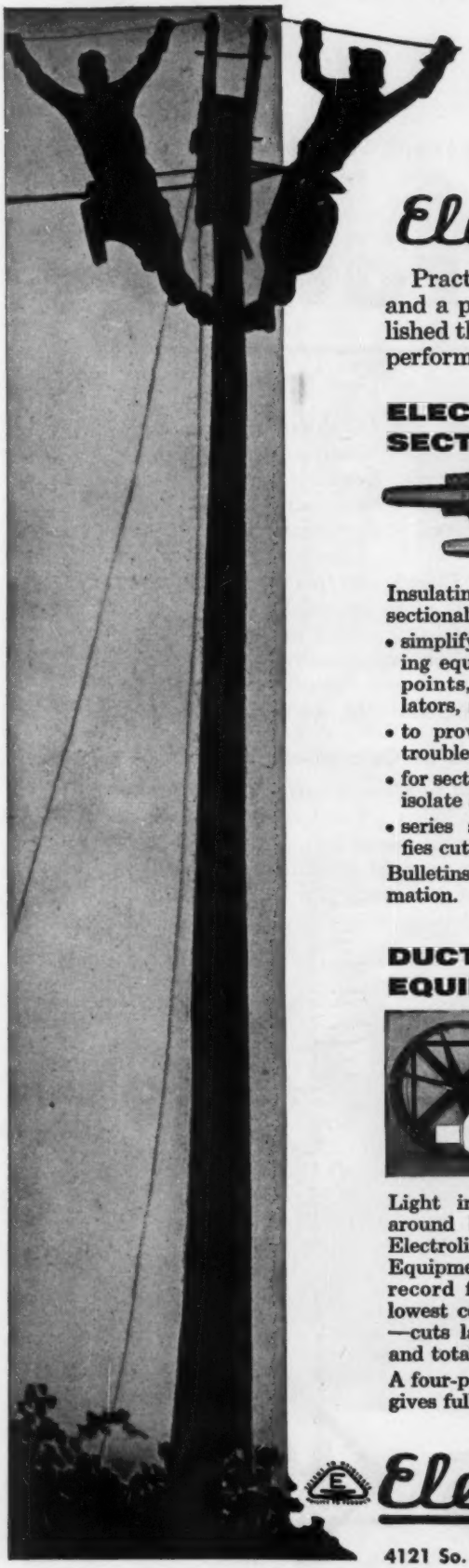


for the largest number of line applications, at the lowest possible cost . . .

Electroline Products

Practical experience designed these Electroline Products; and a practical habit of keeping close tab on costs has established them as first in the field—for top quality and economical performance.

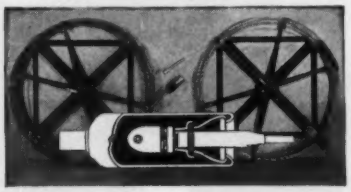
ELECTROLINE SECTIONALIZERS

Insulating automatic line splice sectionalizers:

- simplify cutting-in of regulating equipment—disconnecting points, fuses, voltage regulators, series capacitors, etc.
- to provide points to test for trouble
- for sectionalizing networks—to isolate and test area in trouble
- series street lighting—simplifies cutting-in series lamps

Bulletins contain complete information.

DUCT-RODDING EQUIPMENT



Light in weight, feeds easily around bends, easy to handle. Electroline Steel Duct-Rodding Equipment has an extraordinary record for high efficiency at lowest cost. A big money-saver—cuts labor cost, original cost and total investment.

A four-page illustrated brochure gives full information.

AUTOMATIC LINE SPLICES

It is well said of these simple, rugged units—"They go on in no time; they hang on for all time." Easy to install—and their mechanical strength exceeds the rated breaking strength of the conductors. Ideal for restoring service.

AUTOMATIC DEAD-ENDS

In a typical "torture" test for strength, gripping and vibration damping features, 100,125,000 recorded vibrations did not develop any sign of failure of conductor in these rugged dependable Dead-Ends. Engineers call it equivalent to 50 years of ordinary service.

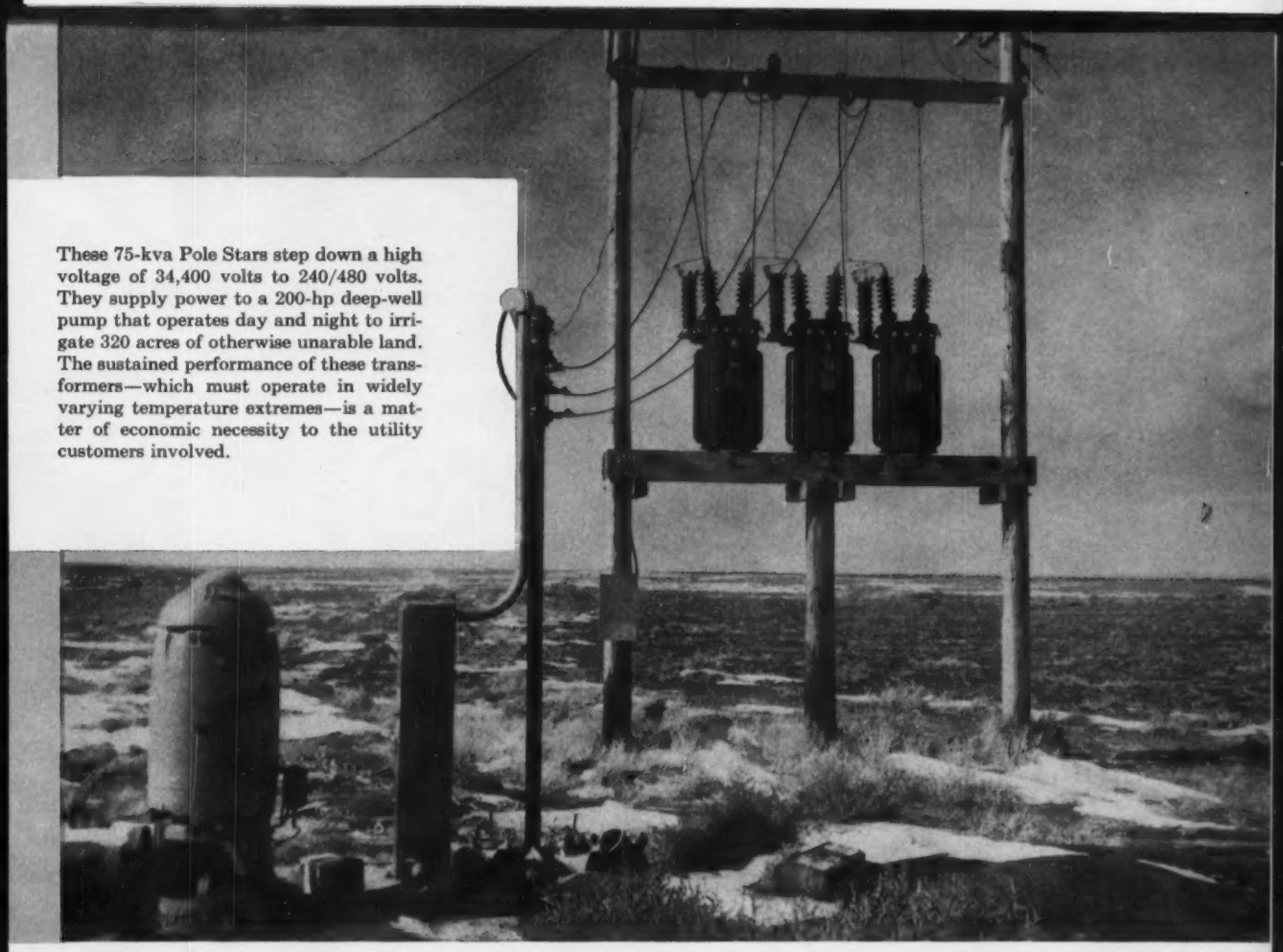
Electroline Service-Drop Automatic Dead End. The "3800" Series for holding pre-assembled service cable using a bare neutral conductor as the messenger.

The method of gripping the bare neutral employed by this ELECTROLINE Anchorage eliminates the danger of short circuiting the phase wires so common with the use of concentric cable clamps.

ELECTROLINE Service-Drop Anchor Bracket. The "4000" Series for securely supporting the cable at any angle.

Electroline Company

4121 So. LaSalle St., Chicago 9, Ill. *In Canada:* POWERLITE DEVICES, LTD., TORONTO



These 75-kva Pole Stars step down a high voltage of 34,400 volts to 240/480 volts. They supply power to a 200-hp deep-well pump that operates day and night to irrigate 320 acres of otherwise unarable land. The sustained performance of these transformers—which must operate in widely varying temperature extremes—is a matter of economic necessity to the utility customers involved.

You Get "Power Transformer Ruggedness" in High Voltage Pole Star Distribution Transformers

With wide experience in the design and construction of power transformers, Pennsylvania Transformer has the specialized knowledge and skill needed to satisfy the rigorous demands of high voltage transformer applications. The internal ruggedness that typifies Pennsylvania's power transformers also is designed into higher voltage Pole Star Distribution Transformers.

For example, the sturdy high voltage lead supports form an integral part of the coil . . . coils have extra bracing top and bottom to protect against possible short circuit forces . . . the core frame is of especially sturdy angle-and-channel construction . . . and tap changers feature power transformer ruggedness in both design and construction.

As a result, high voltage Pole Stars deliver economical, sustained performance in even the most demanding distribution transformer applications. The pictured 34,400-volt installation is a convincing example. For more details contact Pennsylvania Transformer Division, McGraw-Edison Company, P. O. Box 330, Canonsburg, Pa.

McGRAW EDISON

PENNSYLVANIA TRANSFORMERS — POLE STAR

PENNSYLVANIA DISTRIBUTION TRANSFORMERS

KIDDE'S NEW DRY CHEMICAL EXTINGUISHER

EASIEST, FASTEST WAY TO KILL FIRE!

Here – from Kidde – is the newest, the fastest, the easiest-to-operate dry chemical fire extinguisher.

Look at the extra large, aluminum handle and trigger – even a gloved hand fits comfortably with room to spare. Pick the unit up – it hangs straight – no awkward angle to throw you off balance.

If fire strikes, follow the simple directions: "Remove Horn" – automatically the trigger safety lock is released – "Pull Trigger" – instantly a cloud of fire-killing dry chemical whooshes out of the nozzle and fire's out! With this unit, designed by Kidde engineers working with Henry Dreyfuss personnel, you don't have to be a trained fireman to get perfect results.

Built for a lifetime of use, the handsome new 20 and 30 pound Kidde dry chemical extinguishers have top ratings from Underwriters' Laboratories, require only 225-250 psi charging pressure. The rugged pressure gauge is recessed in handle for maximum protection. Tells at a glance if the unit is ready for use.

Available nationally through Kidde's sales and service organization. Write Kidde today for the name of nearest distributor.

Walter Kidde & Company, Inc., 830 Main St., Belleville 9, N. J.

Walter Kidde & Company of Canada Ltd., Montreal—Toronto

Kidde

Cable insulated with G-E silicone rubber increases capacity of existing conduit, reduces danger of heat failure

You can provide for future load increases and protect against temporary overloads without using larger conductors . . . because power cable insulated with G-E silicone rubber carries *up to 50 percent more current* than the same size conventional cable. This means you can often replace old cable with higher-capacity silicone-rubber cable without ripping out existing conduit.

Power cable insulated with General Electric silicone rubber has long service life at operating temperature of 125°C. — particularly important during "heat storms" when summer heat both increases system loads and raises earth temperatures, making normal heat dissipation more difficult.

Besides outstanding high-temperature performance, General Electric silicone rubber gives you the best combination of properties needed in cable insulation: It has low moisture absorption. It has the best resistance to ozone of any flexible insulating material. It stays flexible at very low temperatures. No special tools, fittings or terminations are needed. Tests prove that silicone rubber lasts longer than other insulation.

For more information—and the names of suppliers of generator leads, power cable and station control cable insulated with G-E silicone rubber —write: General Electric Company, Silicone Products Department, Section E4L8, Waterford, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Silicone Products Department, Waterford, New York

Another world's record!

Once again ELLIOTT builds largest 2-pole induction motor

last year it was 5000
(see 1956 advertisement)

this year it's 6000 HP

3600 RPM

In fact, Elliott is now building *four* 6000-hp 2-pole squirrel-cage induction motors—all of them the largest ever built. The one shown under construction above (totally-enclosed, water-to-air cooled) will drive boiler-feed pumps for a large eastern utility.

Elliott's continued leadership is shown by the fact that Elliott has recently built or has on order 39 of the largest 2-pole machines . . .

- 11 motors . . . . . each 4500 hp
- 24 motors . . . . . each 5000 hp
- 4 motors . . . . . each 6000 hp

That's a lot of horsepower. And it reflects confidence in Elliott's long experience in building large 2-pole machines. The first large 2-pole motor ever built was manufactured by Elliott in 1916. Since then, Elliott has developed numerous design improvements including weather-protected motors, fabricated steel enclosures, and "super-quiet" machines. For complete information, write Elliott Company, Ridgway, Pa.

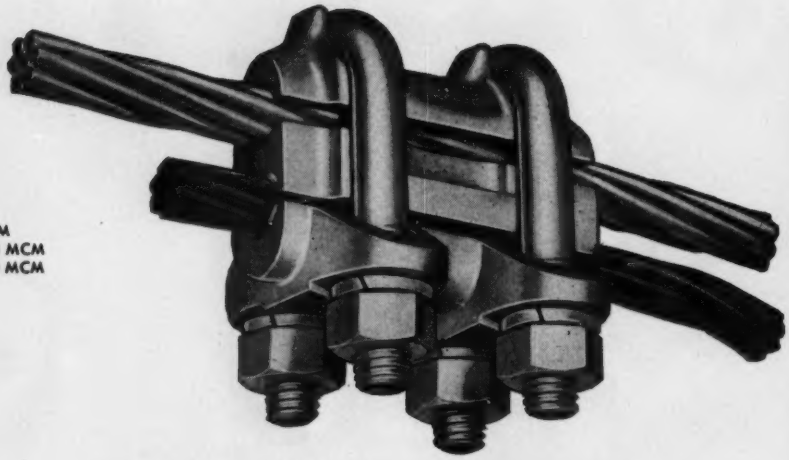
ELLIOTT Company

Ask for "Milestones" booklet
It gives the full story on Elliott 2-pole motor design

RT-25

CORROSIVE SOLDERING ELIMINATED!

in BLACKBURN'S Heavy Duty Bi-Metallic Connectors

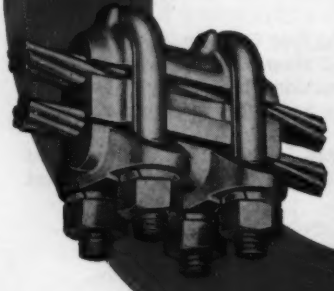


Sizes available to accommodate ACSR 2—2[illegible].4 MCM Alum. 1 Str.—397.5 MCM Copper 4 Str.—250 MCM

PRESSURE SEALED, SHRINK-FIT COPPER LINER SEALS OUT AIR AND MOISTURE—PERMANENTLY!

- Manufactured under controlled atmospheric conditions!
- Eliminating corrosive solders and fluxes between copper liner and aluminum casting insures permanent high conductivity.
- Factory applied protective coating prevents oxidation of contact spacer grooves during transit and storage.
- Castings are high-strength, heat-treated alloy with exceptionally heavy cross sections.
- Clamping forces are distributed over extra long surfaces—contour of grooves protects conductor.
- All Aluminum hardware is alumilited to prevent seizing—bolt features rolled threads of greater strength.

Sizes available to accommodate ACSR 2—2[illegible]4 MCM Alum. 1 Str. [illegible]97.5 MCM



HEAVY DUTY ALL ALUMINUM CONNECTORS

Also available without copper liner for Aluminum to Aluminum. Coefficient of expansion same as conductor. Same high standard of material and construction as above connector.

BLACKBURN *High Strength* **CONNECTORS**

JASPER BLACKBURN CORPORATION

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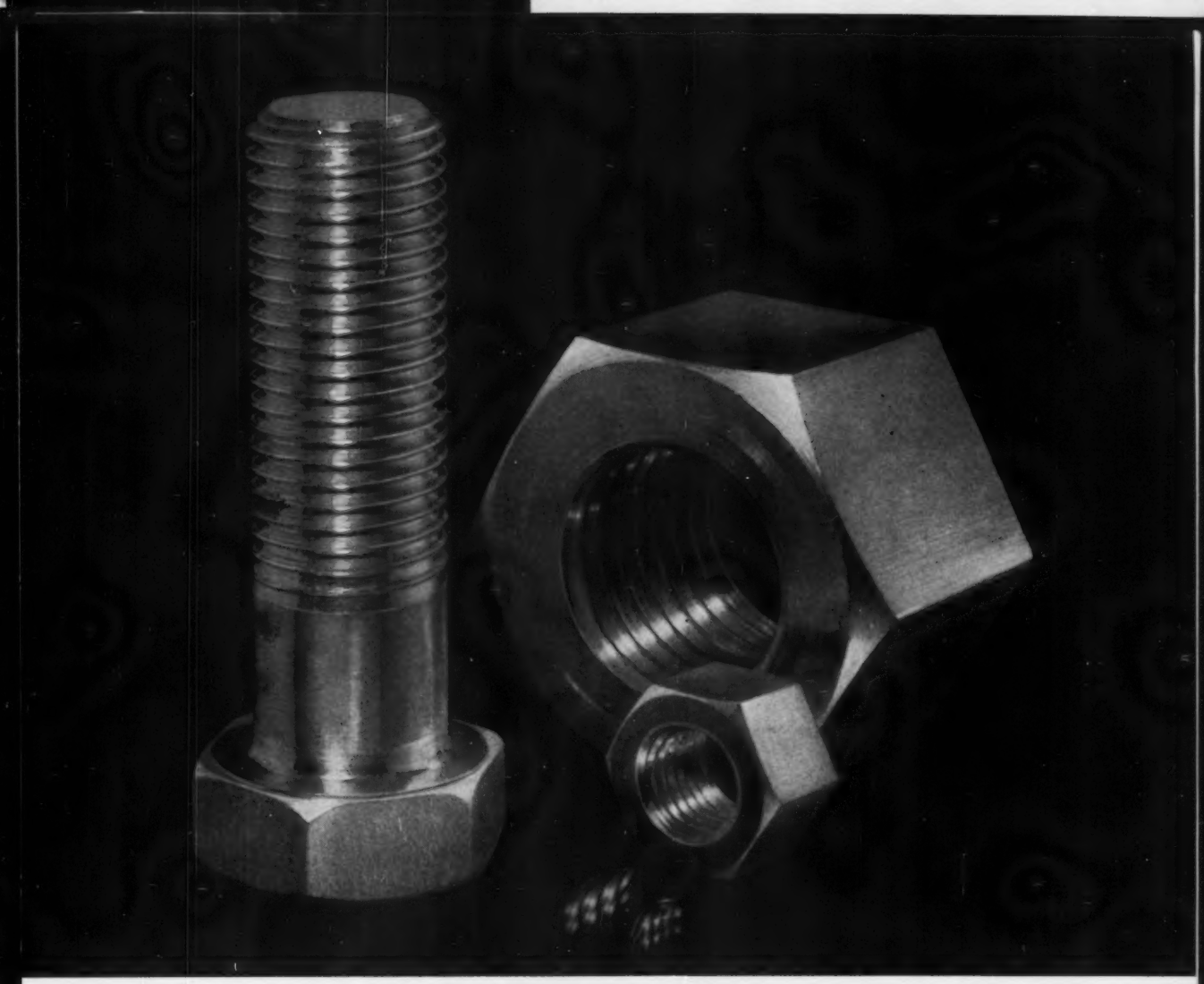


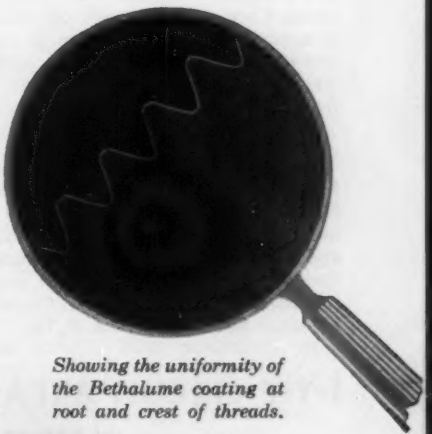
Better Protection Against Corrosion

Fasteners stay on the job for longer periods of time, and in virtually all kinds of atmosphere, when protected against corrosion with Bethalume—Bethlehem's hot-dip coating of pure aluminum.

The Bethalume coating resists corrosion for long periods because it is vastly superior to other types of hot-dip coatings. The Bethalume coating is applied to the base steel by a special technique, providing a corrosion-resistant surface which is unusually uniform over the entire area of the article. As a result, threads are cleaner and sharper than is the case with other hot-dip coatings.

Because of its uniformity, plus the superior corrosion resistance of aluminum, the Bethalume coating has the ability to provide exceptional service just about anywhere—even in high-temperature corrosion applications.

Like to look into the service life of Bethalume-coated fasteners in corrosive atmospheres? If so, just drop a line to the nearest Bethlehem sales office.



Showing the uniformity of the Bethalume coating at root and crest of threads.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

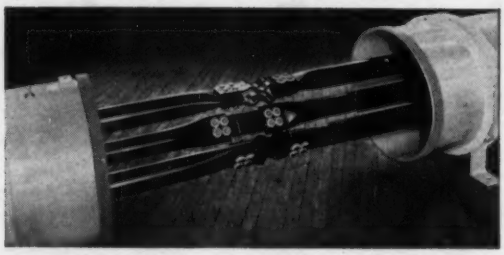
BETHLEHEM STEEL

NONSEGREGATED PHASE BUS

. . . completely sealed, air and porcelain insulated

I-T-E adds another first to its achievements in the design and development of bus structures—4.16, 7.2 and 13.8 kv., 1200-3000 ampere nonsegregated phase bus that is completely sealed and air and porcelain insulated. No organic materials are used for insulation. Cork neoprene-gasketed split-half round covers provide a completely sealed bus that can be used indoors or outdoors; bare copper or aluminum conductors are mounted on purified porcelain which has high dielectric strength, is inherently contamination free. The entirely new design has other outstanding advantages, too. The circular design permits installation in much less space. Flexible or laminated connectors make unit sections easier to install.

I-T-E nonsegregated phase bus is ideal for generator leads to transformers, for connecting transformers to switchgear assemblies, for interconnecting switchgear assemblies, and for distribution of light and power in factories and office buildings. For complete information on this new I-T-E product, contact your local I-T-E sales representative. Or write I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.



COMPLETELY SEALED, AIR AND PORCELAIN INSULATED DESIGN eliminates organic insulating materials, permits use indoors and outdoors. Circular construction permits installation in much less space, provides optimum performance—mechanically, thermally and electrically. Laminated connectors provide unusual flexibility, simplify installation. Also compensate for expansion and contraction in service.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

IN CANADA: EASTERN POWER DEVICES LTD.

NEWS-SCOPE

FUTURE NEWS ▶ **Decision is expected this week on Florida Power & Light Co rate case.** FP&L, ordered to cut its charges by the state Railroad and Public Utilities Commission, has offered a reduction of about $4.4 million.

Keep sharp eye out for significant changes in Atomic Energy Commission use of electricity carried on Statistics Page (100). In past two weeks there has been an estimated drop of nearly 9% in this use. Question is whether this is merely a temporary cutback or does it presage change in AEC production of fissionable material.

With New Jersey P&L Co considering a 100 Mw pumped storage hydro project, look for more such projects to be considered in eastern part of the country.

LATE NEWS ▶ **Sen Kefauver explores what electric utilities do with funds made available through fast tax amortization.** In one-day hearing he questions distribution to stockholders—in form of "return of capital"—money accumulated through fast tax benefits. When a corporation pays dividends, he points out, stockholder must pay tax on it. But when shareholder gets a capital return it's not considered as income and is not taxable. This has occurred, FPC officials testify, but it's legal under present tax laws.

Charges of "cutthroat competitive practices" brings investigation of Pacific Power & Light Co, says Oregon PUC commissioner. Complaints allege departure from published tariff rates in seven or eight areas where PP&L competes directly with municipals, co-ops, or PUDs. Probe will explore practices, services, and probably the company's rate bases.

"Guidepost" rules will help Mississippi PSC steer a "middle course" in rural co-op and private utility squabbles. New guide on practices and procedures enables commission to consider a manufacturer's choice before determining who should provide service. Private companies will be permitted to seek additional certificate to serve co-op areas taken in by expansion of municipal boundaries.

Mexico City quake damage to 19 power plants is negligible, says Mex-Light. Sixty feeders were damaged but 'round-the-clock work restored service within 25 hours. Underground system wasn't affected and h-v transmission lines only slightly damaged.

Northern States Power will take over Wisconsin Hydro Electric Co property and net assets about Dec. 1. Contract for the $6 million purchase is subject to stockholder, PSC, and FPC approval. Transaction involves an exchange of stock.

Congratulations . . . Carl O. Carlson is senior vice president at Atlantic City Electric Co. James P. Hayward is elected VP in charge of electrical operations . . . John F. Pennington, Georgia Power Co's VP, operations, takes over engineering duties also . . . R. J. McMullin is Salt River Project general manager.

ELECTRICAL WEEK

A TWO-MINUTE

EVENTS ▶ **New strategy for the war against the pileated woodpecker** is sure to result from the research efforts going on at Pennsylvania State University. Progress report on the research suggests effective chemical and mechanical means of deterring the birds from pole destruction **(p 48)** . . . Electric utilities might offer to share gains of bond redemption with bond holders as an alternative to non-callable clauses in bond contracts **(p 46)** . . . Larry Nichols, new president at Superior Water, Light & Power Co, has penchant for boats, trout, and service to the public **(p 45).**

WASHINGTON ▶ **FPC examiner endorses electric company development** of lower Snake River and recommends that Pacific Northwest Power Co build the Mountain Sheep and Pleasant Valley projects **(p 43)** . . . New atomic power authorization bill cleared by the Joint Congressional Committee stresses federal role **(p 42).**

ATOMIC PROGRESS ▶ **Britain's Calder Hall nuclear reactor,** planned as a stop-gap electric power producer, is expanding into a more permanent program while there's been a cutback on development of other advanced reactors, recent annual report discloses **(p 43).**

UNDERGROUND ▶ **"Underground Systems Reference Book," the new EEI publication,** is complete and authentic, says our book reviewer in a three-page discussion of and introduction to the volume. Among others, he commends the section dealing with pipe-cable systems as one of particular significance in face of today's need for transmitting bulk power in built-up areas. He points, too, to the comprehensive documentation on cable loading practices. Our review also introduces you to Jim Pulsford, the hard-working engineering executive for Public Service E&G, who directed the activities of the 134 experts who wrote the Reference Book **(p 53).**

SUBSTATIONS ▶ **Effective corona shields for 138-kv bus connections** cut radio interference on the Con Edison system. These custom-designed shields have smooth surface and fit over connections **(p 70).**

DISTRIBUTION ▶ **Take a bold, uninhibited look at future distribution requirements.** That's exactly what Author H. G. Hally, engineer in charge of T&D at Iowa P&L, does in his stimulating article beginning at **page 62** of this issue. He suggests use of 69 and 34.4-kv primaries for future residential areas with 7.6 and 2.4-kv secondaries. Each home would have an individual distribution transformer with primary winding adaptable for supply up to 15 kv. Service would be underground cable. Utilization voltages would remain at 120/ 240 v in his scheme of things. There are plenty of advantages—ample capacity for customers, great flexibility, less troublesome overhead system. But it would require heavy initial outlay, provide no diversity of transformer loading, and mean higher transformer losses.

PREVIEW OF THIS WEEK'S ELECTRICAL WORLD

METERING ▶ **Ultrasonic method of cleaning meter registers** offers a real short-cut on the time and money-consuming task. Ultrasonics, combined with a carefully developed procedure, has enabled Long Island Lighting to cut cleaning costs from an average of $2.77 under the most refined previous methods to around $1.37 per register for an estimated annual saving of around $11,000. Selection of solvents, LILCO finds, is just as important as the ultrasonics device. LILCO Meter & Test Supt. J. W. Dye and Associate Engineer A. Howard tell how the procedure has been developed **(p 56).**

RELAYING ▶ **Here's a tip for matching smaller current transformers** with circuit breakers' momentary current ratings. You're assured of good results when the current transformer's mechanical rms symmetrical rating is 60.3% of a power breaker's total rms momentary rating or 70.7% of the breaker's average total rms interrupting rating. Frequently the current transformer can be of even lower rating selected to withstand available short-circuit current. Such matching is permissible because the transformer's mechanical strength is rated on a different basis from the momentary rating of the breaker. The article illustrates the matching of CTs with breakers by citing a specific example and also provides explanation of the rating methods used **(p 60).**

RATES ▶ **Electric utilities have asked for known rate increases totaling** $60 million since the first of the year. This compares with only $7 million in increases requested during all of last year . . . Texas Baptists seek lower rates with argument that most churches use off-peak power **(p 101).**

PERSONNEL ▶ **Foremen are playing larger role on management team,** recent survey of all industry indicates. More are taking part in management meetings. More special training is being provided for foremen **(p 102).**

PEOPLE ▶ **At Consolidated Edison, Charles E. Eble is new president** and Harland C. Forbes is board chairman . . . At Public Service E&G, Francis A Keane is a new vice president and board member **(p 108).**

MANUFACTURERS ▶ **Mergers: Elliot becomes an operating division of Carrier Corp.** Reliance Electric & Engineering merges with Master Electric Co . . . Roebling expands power cable plant and installs four bobbin cabling machines and neoprene vulcanizing equipment **(p 104)** . . .Detroit Ed gets 360 Mva transformer from Westinghouse **(p 106).**

NEW EQUIPMENT ▶ **New 30-amp single-phase watthour meter has "on-line" accuracy up to 200 amp.** New design improves accuracy . . . New truck bed elevating platform will lift 1,000 lb up to 70 ft. Platform measures 8 by 14 ft . . . New insulation measurement device has low resistance, capacitance discharge, and divider circuits in addition to conventional high-resistance measurement range **(p 83).**

ENGINEERING TRENDS

All-aluminum conductor offers advantages for 230-kv wood structure lines. Eliminating the weight of the customary steel core helps to keep wire tension down to levels desirable for the structural characteristics of wood and low enough to avoid dangerous vibration without using dampers.

Sensitive indicator for fault locating is a cathode-ray tube with its Y-Y axis plates connected from probe to ground and its X-X plates, from faulted conductor to ground. The probe picks up voltage capacitatively through wire insulation from a 1,000-cps mid-point-grounded signal applied to the two ends of the faulted conductor. The CRT trace gives a distinct no-voltage indication at a break in the wire, even when the break is buried in insulating material.

Accelerating growth of transmission systems poses new fault problems. Interrupting duties on circuit breakers and other equipment will continue to climb, stiffening the recovery voltage after initial clearing. But engineers will focus on the counter effect of multiple lines and growing substation loads for help and seek solutions for the high-frequency oscillations of line faults which will then become the most difficult interruption problem.

Bubble formation in the oil of sealed power transformers subjected to cyclic loading can be alleviated by restricting the nitrogen-pressure range to ½ to 2 psi. But doing this vents more gas during load peaks.

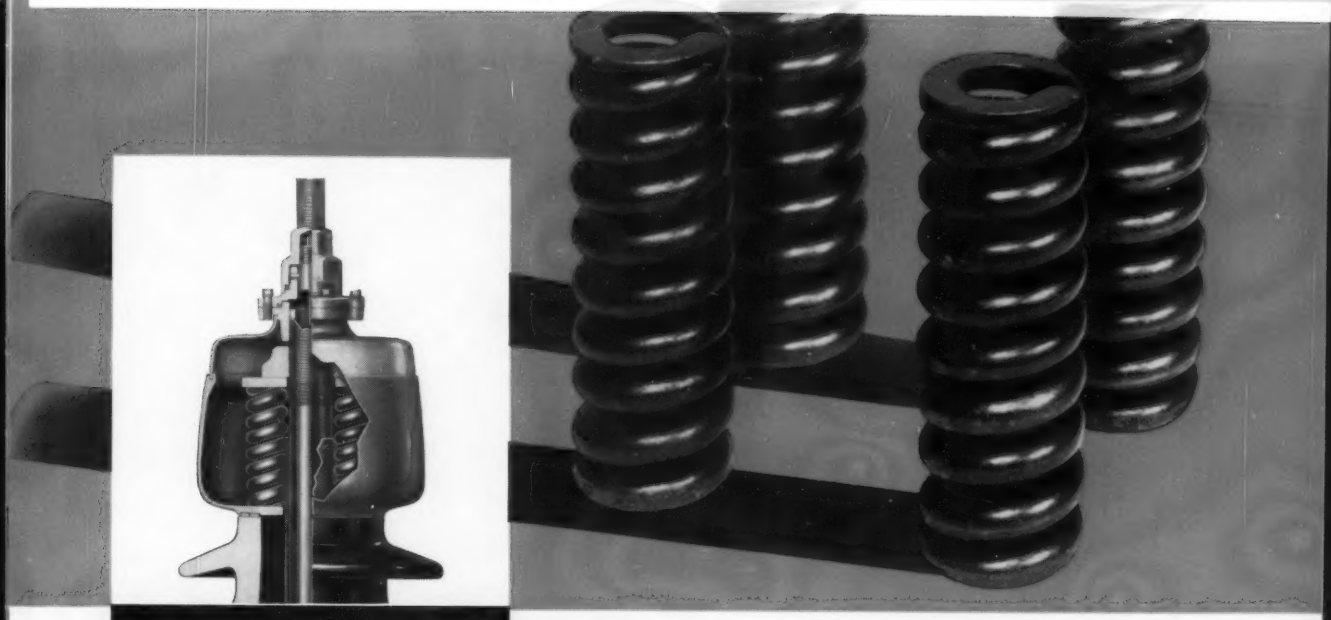
Savings up to $15 per student are achieved by use of 277/480-v distribution in lieu of 120/208 for today's ranch-type schools. Feeder runs of 200 ft and more, which are not at all unusual, assure savings with the higher voltage even where much of the load requires 120-v service.

Nobelium is the name proposed for element 102 derived from curium by bombardment with carbon 13 ions accelerated by a cyclotron. Thus the periodic series has acquired a fourth new element to accompany einsteinium 99 and fermium 100, found in the first H-bomb debris, and mendelevium 101, also discovered by radiation scientists.

FROM EDITORS IN THE FIELD

Pushing 110 ft of 6-ft-diam corrugated steel pipe under railroad tracks enabled Iowa P&L Co to build a cable duct line under the main lines of three railroads without interrupting traffic and at a reasonable cost.

Single-phase 120/240-v service has proved much cheaper than 240-v 3 phase for every one of 8 typical examples of air-conditioning and heat pump installations recently surveyed by Kansas City P&L Co.



Why O-B Bushings Stay Tight!

Refinement of assembly method preserves life of compression springs.

There was room for improvement in bushing assembly—improvement on the spring compression principal O-B originally developed. Springs must be steel. This meant danger of magnetic heating in the strong field of a bushing conductor if a single spring surrounded that conductor, as was often the case.

Now, in the new O-B condenser bushing, a nest of springs do the work. All are external to the conductor. There's more safety in numbers, and heating is negligible.

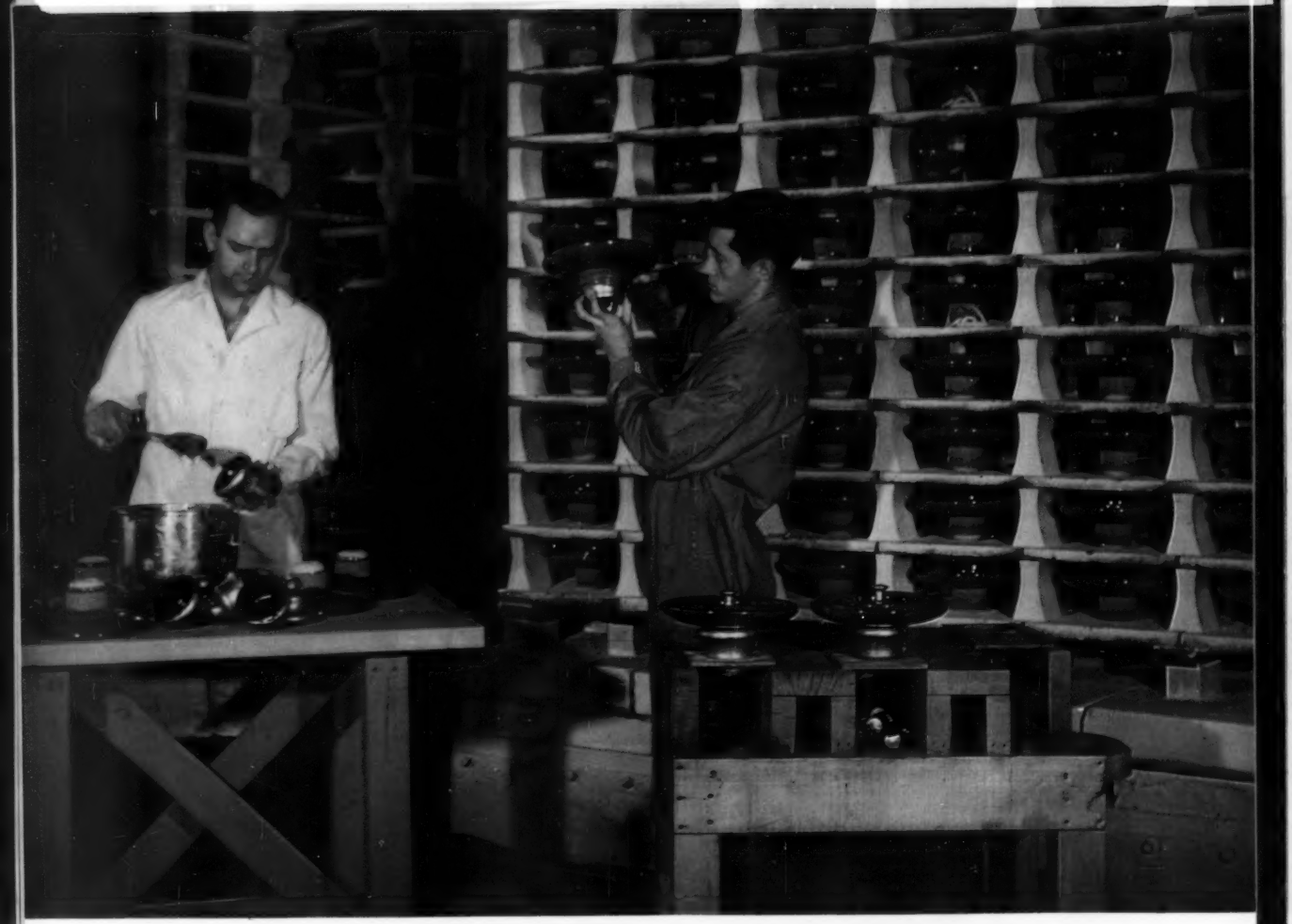
To be sure the springs "stay out of the act" in carrying current, the lower portion of the reservoir where the springs seat is insulated from the central conductor. Thus, another possible cause of trouble has been eliminated.

Such design refinements are typical of the new O-B condenser bushing line. After making bushings for 50 years, we knew where sound refinements were needed.

When you specify O-B bushings for your new apparatus you will be getting the cleanest piece of modern design on the market today. It will pay off in better service.

Ohio Brass

4793-H



WE RUN A PRE-VIEW TO GIVE YOU MORE RELIABLE INSULATORS

Ahead of All Other Inspection of Fired Pieces, A Realistic Check is Made on Completely Assembled Samples

These insulators are still warm out of the kiln. By using short-cut methods, fully assembled samples will be under test in a few hours. Before any part of this production batch has been mingled with others, its representatives will have passed a series of special inspections and tests. This will be in the form of *finished insulators*, not simply separate pieces. In this way we pre-view our production. It is one more assurance of an absolutely consistent product.

Naturally, this is no substitute for almost hundreds of tests, measurements, inspections, and checks that follow later. But we know each batch is basically good before all this starts. It's one of the safety measures that show up later in the remarkably high performance records of O-B insulators in the field.

Careful inspection, ingenious inspection, thorough inspection, realistic inspection, all add up to complete reliability. This is one of the unseen extras you get in the package -- at no extra cost -- when you use O-B insulators.

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

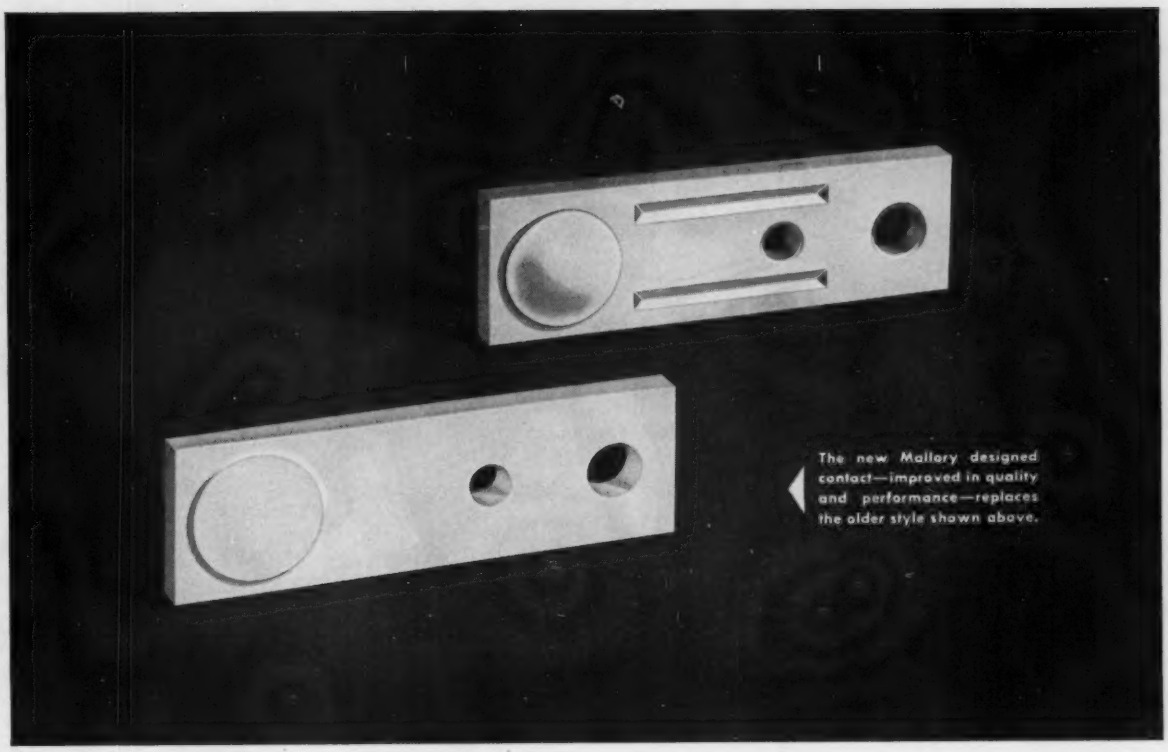
TECHNICAL COMPETENCE

Ohio Brass

4820-H

THE HEART OF EVERY INSULATOR

PRINTED IN U.S.A.



Production and Delivery Problems Solved by Mallory Contact Design Service

A major electrical equipment manufacturer required heavy duty contact assemblies made to rigid specifications. The original design called for hard drawn copper. To retain the hardness, contacts were brazed with a quick shot of heat—on a resistance welder. The silver solder frequently balled up, requiring hollow milling to remove surplus. Deliveries were often delayed—rejects ran high.

Mallory Contact Design Service proposed an alternate design. By switching to Mallory 3 metal, brazing was made easier. The use of Mallory 3 eliminated a hardening operation and enabled holes to be punched instead of drilled. Measured hardness at critical points is now guaranteed.

The customer benefited—almost no production problems, rejections were eliminated, delivery schedules could be met. Field life of the contacts within the finished equipment was greatly improved. Thanks to Mallory Contact Engineering Service, another customer got a better component, better service and a better product at no increase in cost.

FIVE MALLORY KEYS TO ECONOMY THROUGH CONTACT ENGINEERING

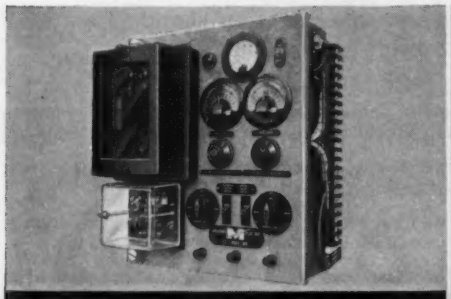
1. The most effective contact material from the extensive line developed by Mallory. More economical alloys often can satisfy *actual* service conditions.
2. The most economical contact design . . . for your purchasing, production and product needs.
3. The most economical backing material . . . from a group of Mallory alloys developed for this use.
4. The most economical backing member design in relation to contact and product design requirements.
5. The most economical method of assembling contact and backing member.

By coordinating *all* these important elements of contact design, Mallory can help you put into effect a long-range plan for cutting contact cost and assuring peak performance.

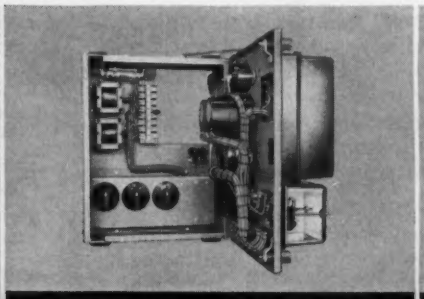
Serving Industry with These Products:

Electromechanical — Resistors • Switches • Tuning Devices • Vibrators
Electrochemical — Capacitors • Mercury and Zinc-Carbon Batteries
Metallurgical — Contacts • Special Metals • Welding Materials

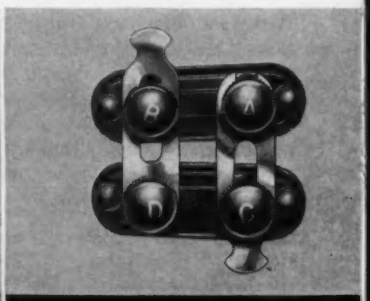
P. R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA



MOLONEY AUTOMATIC CONTROL SYSTEM—controls a load tap change by (1) sensing and evaluating the magnitude and direction of the voltage deviation, (2) by delaying the signal until the merit of the deviation is determined, and (3) initiates the switch mechanism through a single tap change or sufficient tap changes to correct the original voltage deviation.



INTERIOR OF AUTOMATIC CONTROL EQUIPMENT PANEL—permits easy access to all control equipment and affords utmost accessibility to all wiring without removing equipment. Access to the interior of the control panel is gained by two quick operating thumbscrews, permitting the hinged front panel to swing out of the way.



REVERSE REACTANCE — requires reversing only the reactance element of the line drop compensator. Terminal blocks for reverse reactance are provided in all control panels as standard equipment.

MOLONEY

Power Transformers • Distribution Transformers • Load Tap Changing Transformers

Unit Substation Transformers • Network Transformers • Series Street Lighting Transformers • Subway

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT

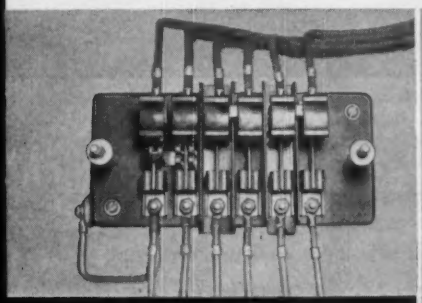
Looking for Buried Treasure?

Control equipment can be buried treasure . . . because even the most valuable, most accurate control equipment is worthless unless it's readily accessible.

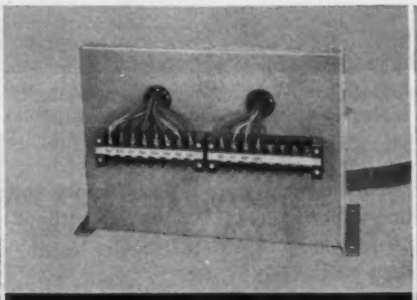
That's why Moloney engineers skillfully designed and located Moloney LTC Transformer controls within one centralized, easily accessible unit. Inspections and adjustments of voltage regulation is accomplished quickly and efficiently.

Moloney LTC Transformer control equipment is flexible, too, because it's easily adapted to parallel operation of two or more transformers.

Specify Moloney LTC Transformers . . . Get Dependability at its Best. MESS-42



CROSS CURRENT—requires interconnecting the current transformers of two units to the line drop compensators of the two units. Connections involved can be brought to terminal blocks which can be installed at any time through provisions incorporated in the design of the standard control panel.



PARALLELING REACTOR—requires a paralleling reactor assembly for each unit and interconnections between the controls of all units. Provision is made in the design of the standard control panel to permit adding this equipment easily at any time.

OUT-OF-STEP INTERLOCK — requires the addition of out-of-step cams, in-step relays and a control switch, and can be installed at any time with a minimum of labor through provisions incorporated in the design of the standard control panel and drive mechanism.

E L E C T R I C C O M P A N Y

Regulating Transformers • Step Voltage Regulators • Primary Unit Substations • Secondary Transformers • Industrial Dry Type Transformers • Magnetic Components for Electronics

ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

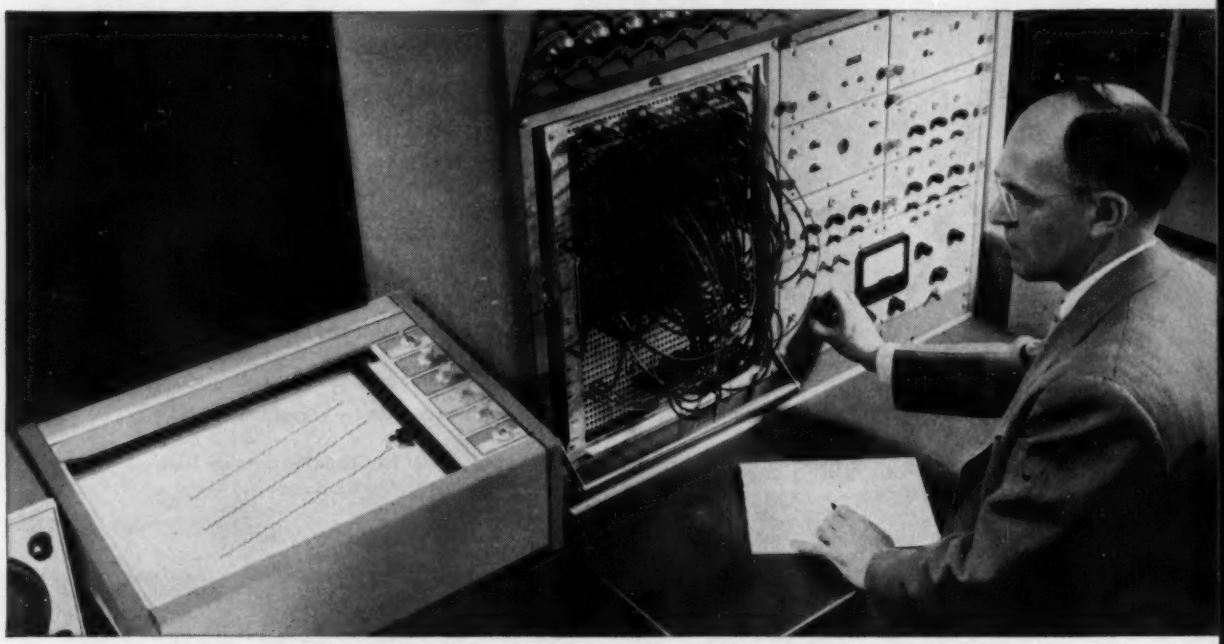
PROVED: WESTINGHOUSE *URL* AND *URF* REGULATORS

Limit voltage error to 1/3 that

PROBLEM: Determine the combination of regulator components that will provide best regulation with greatest reliability, least maintenance

APPROACH: Analog computer to simulate operation of various controls and tap changers, and to evaluate the performance under conditions found on utility systems

ANSWER: Combination of 1¼% steps, inverse time delay, instant-response tap changer



H. L. Prescott, Development Engineer, Westinghouse Transformer Division, obtains regulator performance data with the analog computer. Conditions of an actual distribution system are reproduced—voltages of various characteristics are generated and applied to simulated regulators.

Extensive studies at Westinghouse with the analog computer have proved this fact of outstanding importance to every electric utility . . . the Westinghouse system of 1¼% step voltage regulation holds set voltage with ½-⅓ the voltage error of any other regulator! Tests compared two major systems (table, right) of step regulator operation, with a ± 1-volt setting, under the three basic supply voltage conditions—smooth changes, large and rapid changes, irregular changes. Results proved that the ability of a regulator to hold a set value is dependent on the kind of voltage sensing device, time delay control and tap changer. Results proved—and without exception—that Westinghouse 1¼% step regulation holds narrowest effective bandwidths, regardless of individual system characteristics.

To the utility, Westinghouse regulation means greater revenue for these reasons:

1. From feeder to customer—fewer operations, fewer regulators, minimum total regulation equipment expense.
2. Satisfactory voltages can be furnished farther out on the line without reregulation.
3. Heavier loading of existing lines is practical.

COMPARE:

A—Westinghouse regulators with 1¼% steps, inverse time delay, instant-response tap changer

B—Other regulators with ⅝% steps, fixed time delay, 7-second tap changer operation

Regulator	Set Time Delay	Maximum Voltage Error	Voltage Error Average
A	minimum	1.15	.20
B	15 second	1.22	.62
A	average	1.21	.25
B	30 second	1.28	.65
A	maximum	1.23	.29
B	60 second	1.34	.63

# of other regulators

G. K. Anderson, Voltage Regulator Sales, points to URL regulator whose superiority has been proved in service through thousands of installations for over ten years.

WESTINGHOUSE URL AND URF DISTRIBUTION VOLTAGE REGULATORS MEAN 42% FEWER OPERATIONS, 15% LESS CONTACT EROSION, FAR LESS MAINTENANCE

Providing these and many other advantages, the following features give you, altogether, the most practical regulators you can buy.

- Instant-response tap changer operates 15 times faster than other tap changers.
- Direct-drive Geneva gear mechanism provides optimum contact speed—eliminates flashover, minimizes contact burning, reduces erosion and carbonization.
- Load range selector—allows higher currents at reduced range operation; you get increased capacity to 160% of rated current at ± 5% regulation up to 400 amps.
- Coastal finish and single-bolt tank construction with no external hardware—maximum protection against corrosion.
- Separate tap changer oil compartment keeps metal and carbon from tap changer out of core and coil—eliminates core and coil maintenance.
- Unique new CVR relay with integral, adjustable, inverse time delay in drawout Flexitest* case.
- Unit assembly of core, coil and tap changer.
- Draw stud bushings with single-bolt cover simplifies untanking (though rarely necessary).

*Trade-Mark

NEW URF STEP VOLTAGE REGULATOR, DEVELOPED AS A RESULT OF THESE EXTENSIVE STUDIES, HAS THESE ADDITIONAL FEATURES:

1. Higher current ratings—extends range of 1¼% step regulator.
2. Built for feeder application—reduces your initial investment for regulators up to 167 kva.
3. Provisions for hand operation.
4. Bridging-type contacts with magnetic yoke eliminate pitting under short circuit, provide maximum mechanical strength.

J-70819

YOU CAN BE SURE... IF IT'S Westinghouse

NEW MD5 HYTOOL

lightweight champ with a heavyweight punch!

237
239
MD5 HYTOOL Installs Hysplices on #4, #2, 1/0 and 2/0 ACSR
Aluminum up thru 1/0, copper up thru #2 and
Crimpits, Eltaps, Linkits, etc. up thru 1/0

Jaw variations make this the versatile, durable tool you can afford to put on every truck. Low in cost, big in performance this new 4¾ lb. MD5 delivers a 6000 lb. force to install a range of distribution connectors on all conductors through 2/0 ACSR.

It's designed to stand the roughest field treatment. Jaws are of heat treated steel. A set screw adjustment compensates for wear. Die letters or numbers on each groove correspond to connector markings to assure correct crimping. Handle grips color-coded for easy identification.

Your Burndy representative will be glad to demonstrate the advantages of the MD5.

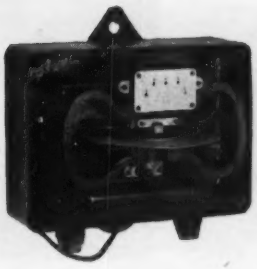
BURNDY

56-14

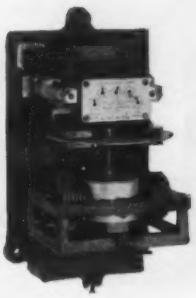
Norwalk, Connect. • Toronto, Canada • Other Factories: New York, Calif., Toronto • Export: Philips Export Corp.

Do you have "MUSEUM" METERS on your system?

The meters shown are from Sangamo's Museum of Metering.

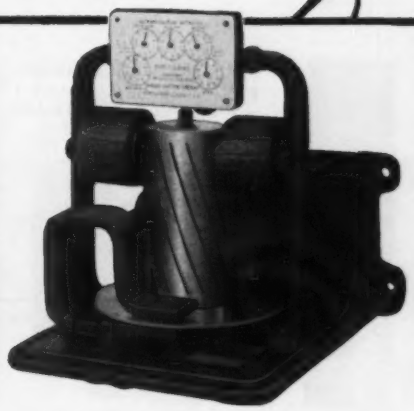


STANLEY A. C. WATTHOUR METER—1902. First meter to utilize principle of magnetic suspension. Sold for $10.00



THOMPSON A. C. WATTHOUR METER—1898. First induction type meter manufactured by Thompson which superseded his commutator type meter. Sold for $14.00

SHALLENBERGER A. C. WATTHOUR METER—1894. First commercial true energy measuring meter of the induction type. Sold for $15.00



GUTMANN A. C. WATTHOUR METER—1899. First A. C. Watthour meter manufactured by Sangamo Electric Company. First meter to utilize slotted armature to cause induced current to move sidewise. Sold for $11.25

More than 15,000,000 meters now in service are obsolete*

Surveys indicate that in addition to the millions of totally inadequate 5 amp. 2-wire meters still in service, there are another 11,000,000 meters of the "doubtful" category on utility company lines.

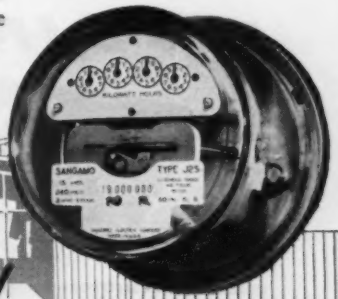
These "museum" meters are spinning at top speed in a hopeless effort to keep on measuring today's residential loads.

Carefully planned meter retirement programs are the wise answer to the problem. And the wise investment in replacement meters is the Sangamo J2—the watthour meter built to handle today's loads . . . *and* the loads of the future.

The Sangamo 15 ampere J2 meter incorporates the most advanced features of modern meter design to offer:

• *Straight line accuracy to 100 amperes* • *Corrosion-resistant construction* • *High torque, lifetime bearing system* • *High insulation level* • *Slow disc speed*

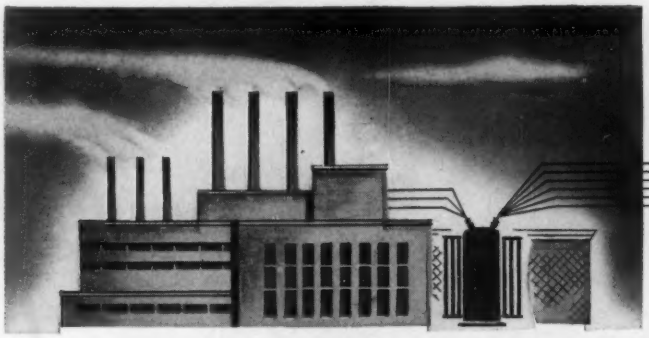
*These figures are based on surveys published in Electrical World. "LOADS OF THE FUTURE AND METERS OF THE PAST" has been reprinted for your convenience by Sangamo. Drop a postcard or a note for your copy of these surveys.

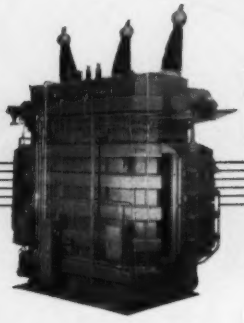


SH 57-4

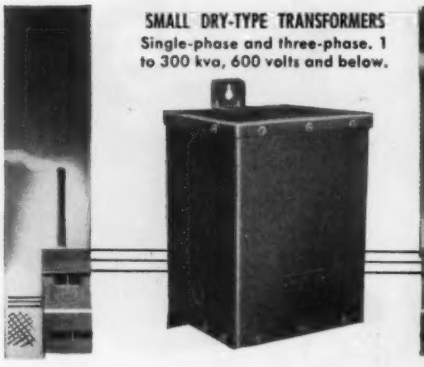
SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

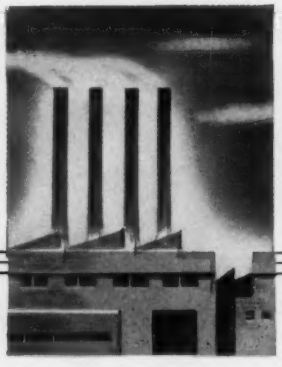


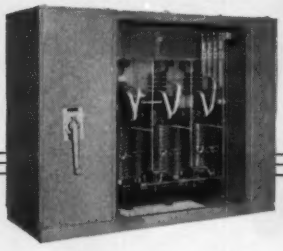


WAGNER TRANSFORMERS



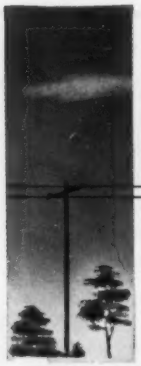
SMALL DRY-TYPE TRANSFORMERS
Single-phase and three-phase. 1 to 300 kva, 600 volts and below.

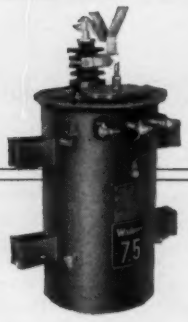


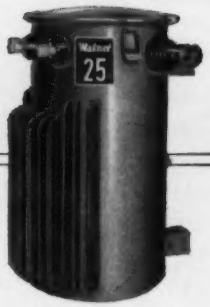


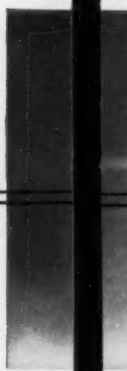
VENTILATED DRY-TYPE LOAD CENTER TRANSFORMERS
Wagner also builds Nitrogen sealed dry-type transformers.

Central Station - - Industrial - -









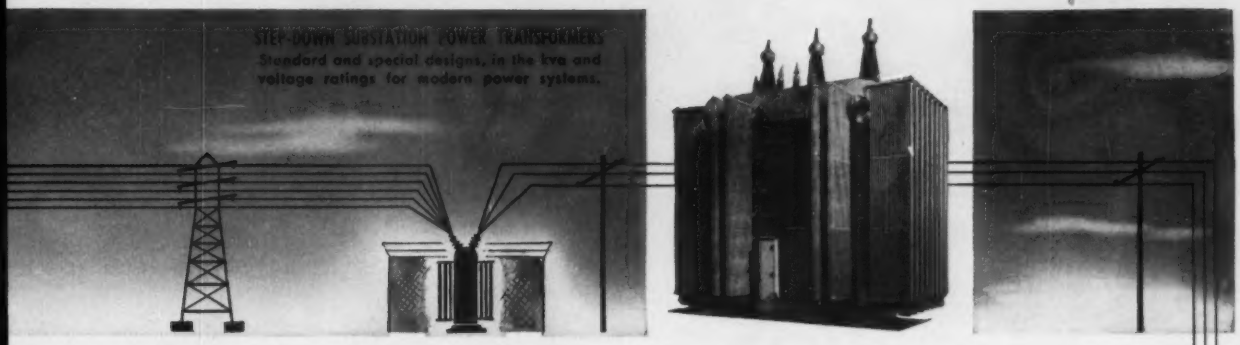
ENGINEERED FOR LONG

T57-14

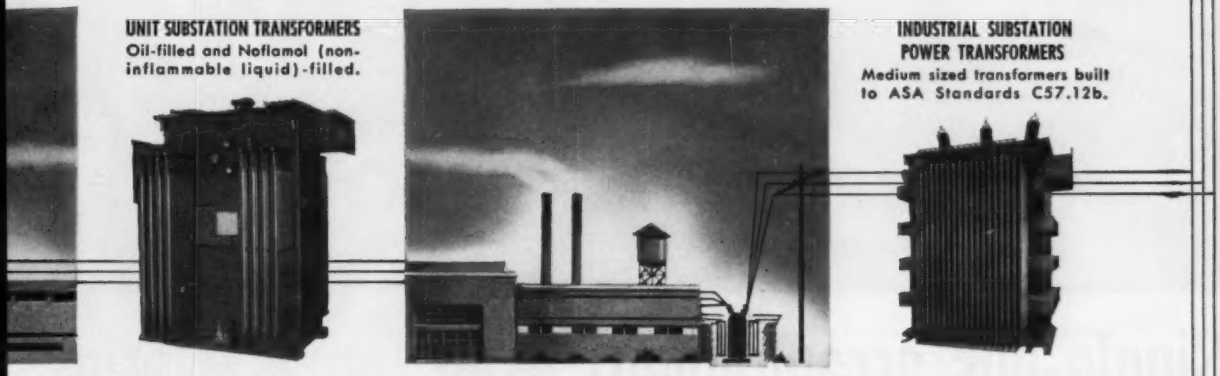
Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

BRANCHES AND DISTRIBUTORS
IN ALL PRINCIPAL CITIES

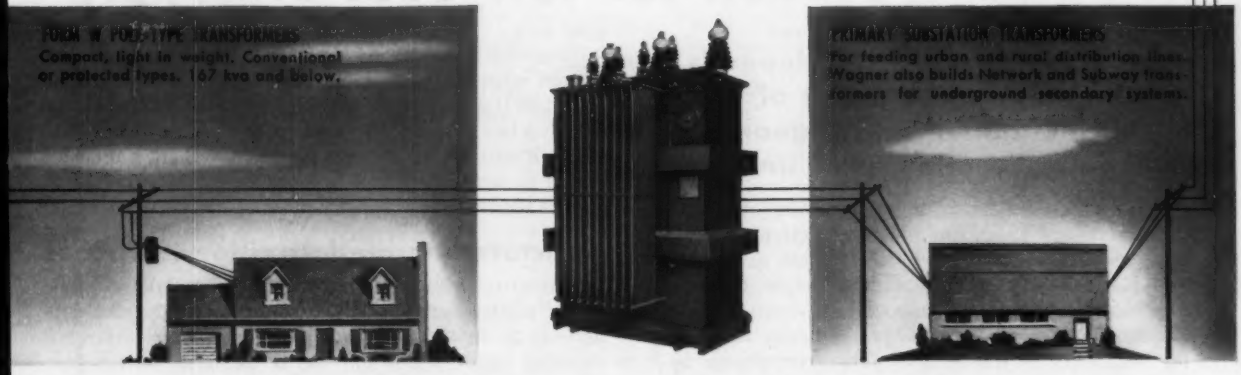
ELECTRIC MOTORS • TRANSFORMERS •


STEP-DOWN SUBSTATION POWER TRANSFORMERS
Standard and special designs, in the kva and voltage ratings for modern power systems.

FOR EVERY NEED . . .


UNIT SUBSTATION TRANSFORMERS
Oil-filled and Noflamol (non-inflammable liquid)-filled.
INDUSTRIAL SUBSTATION POWER TRANSFORMERS
Medium sized transformers built to ASA Standards C57.12b.

Transmission - - Distribution


Compact, light in weight. Conventional or protected types. 167 kva and below.
PRIMARY SUBSTATION TRANSFORMERS
For feeding urban and rural distribution lines. Wagner also builds Network and Subway transformers for underground secondary systems.

DEPENDABLE SERVICE

Wagner Electric Corporation
6456 PLYMOUTH AVENUE, ST. LOUIS 14, MO., U. S. A.

LIVE BETTER ELECTRICALLY

INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR & HYDRAULIC

Single-bus arrangement used for auxiliaries at Palatka Station for low cost of supply

Florida Power and Light depends heavily on reliability of Allis-Chalmers switchgear for power continuity of Unit 2

The entire design was based on maximum reliability for a minimum cost of equipment and construction. Outdoor type of construction provided the greatest savings, of course. Keeping the auxiliary supply simple, by using a single bus, also resulted in important savings .

This auxiliary supply scheme places heavy emphasis on the reliability of the Allis-Chalmers switchgear because the entire generating unit is completely dependent on the one bus and one set of switchgear for the essential auxiliary drives.

Start-up power is provided by a tie to Unit 1 auxiliary switchgear bus. A manual synchronized closed-circuit transfer is used during start-up. If generating Unit 2 goes off the line, auxiliaries may be kept in operation by power from Unit 1.

In emergencies, an open-circuit transfer to the reserve source is used, and in this case a voltage decay relay monitors this throwover and permits its completion when residual bus voltage generated by motors has decayed to 25%. Engineers at Florida Power and Light Company found by actual test that a voltage decay of about 75% occurs within 50 cycles.

Structure Mounted Auxiliary Switches

One unusual feature of the switchgear at Palatka is the use of positive acting auxiliary switches on the structure as well as on the breaker. These structure-mounted switches simplify the addition of auxiliary switch contacts and avoid the need of cell switches.

Allis-Chalmers engineers worked in close cooperation with engineers from Ebasco Services, Incorporated and Florida Power and Light Company. This is one of many station auxiliary switchgear lineups built by Allis-Chalmers. For an answer to your switchgear problems, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

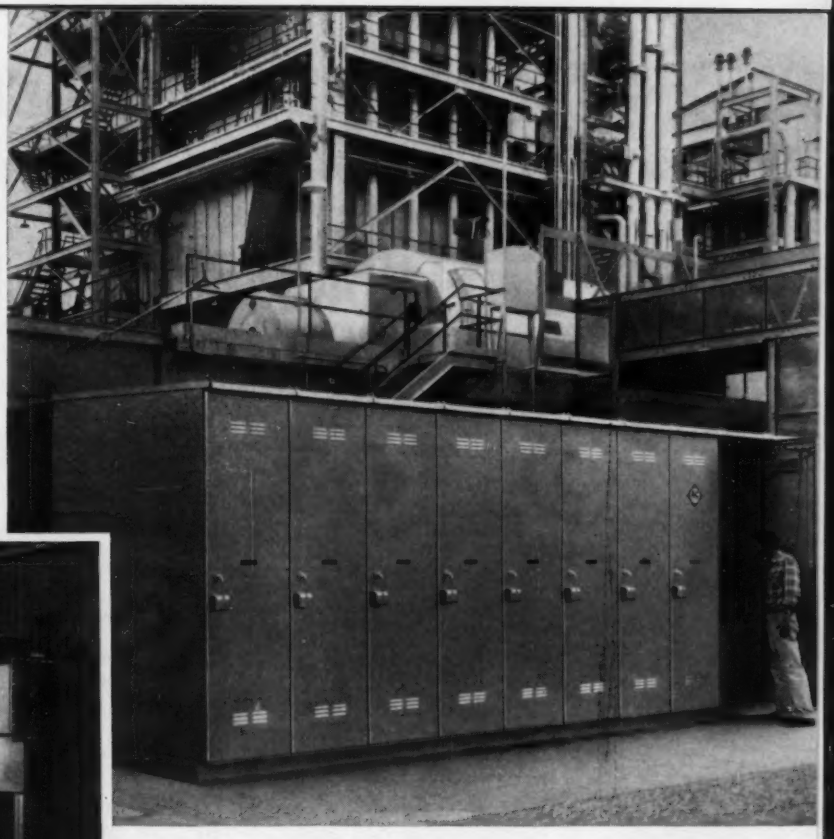
For Progress in Switchgear

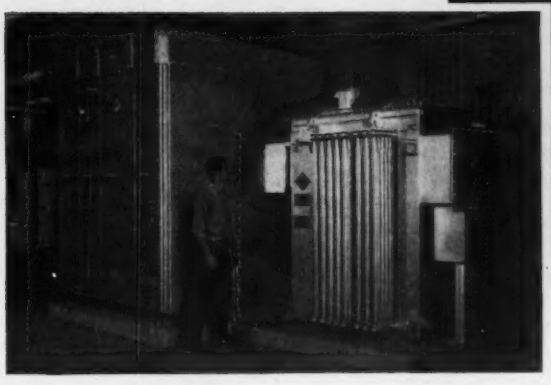
ALLIS-

Palatka Station has an installed capacity of 128,000 kw. Outgoing power is transmitted at 115 kv and 69 kv.

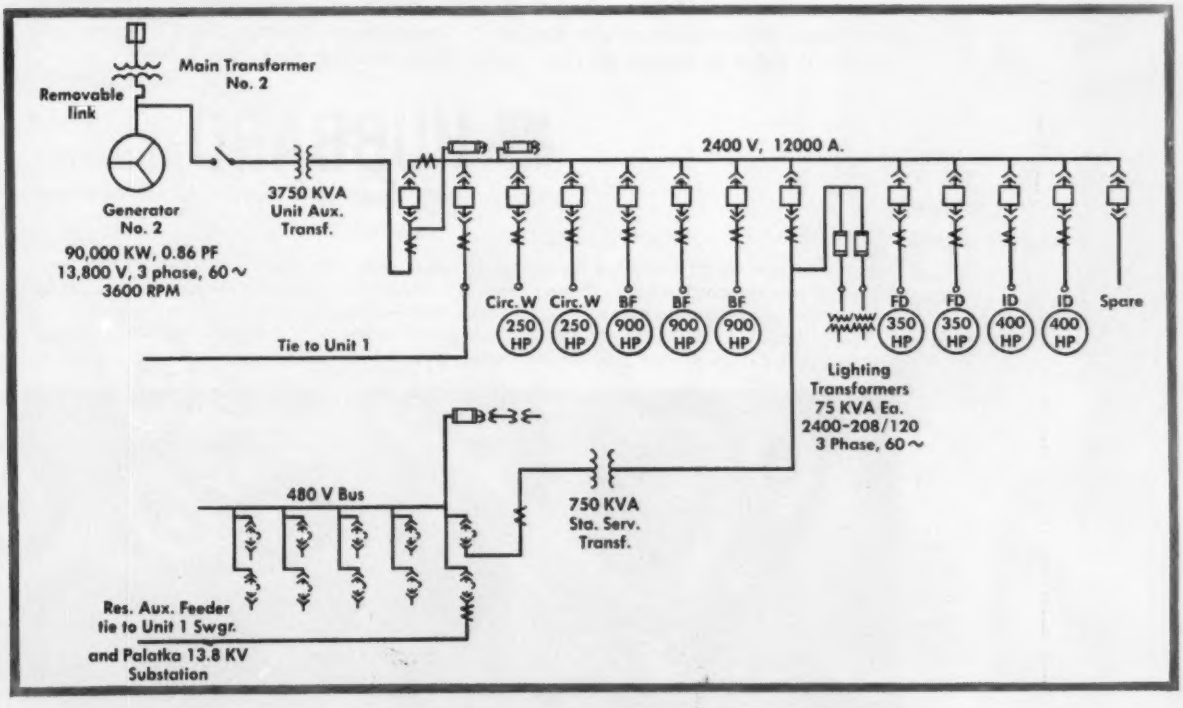
Unit substation type construction was used on both the 2400-volt and 480-volt switchgear to conserve space and provide good appearance.

Allis-Chalmers outdoor-type 480-volt low voltage switchgear is used on circuits for lighting, condensate pumps, lubricating oil pumps, motor control centers and fuel oil boosters.





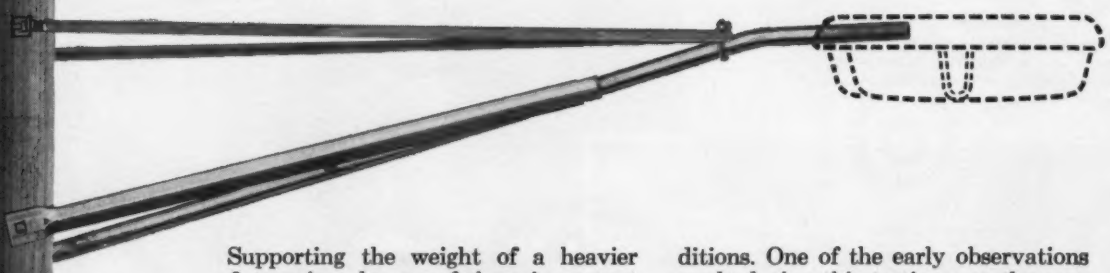
Ebasco Services, Incorporated, Engineers and Constructors.


Main Transformer No. 2
Removable link
Generator No. 2
90,000 KW, 0.86 PF
13,800 V, 3 phase, 60 ~
3600 RPM
3750 KVA Unit Aux. Transf.
2400 V, 12000 A.
Circ. W 250 HP
Circ. W 250 HP
BF 900 HP
BF 900 HP
BF 900 HP
FD 350 HP
FD 350 HP
ID 400 HP
ID 400 HP
Spare
Tie to Unit 1
Lighting Transformers 75 KVA Ea. 2400-208/120 3 Phase, 60 ~
480 V Bus
750 KVA Sta. Serv. Transf.
Res. Aux. Feeder tie to Unit 1 Swgr. and Palatka 13.8 KV Substation

CHALMERS

A-5504

SPECIALLY DESIGNED HUBBARD BRACKETS ANSWER ALL THE REQUIREMENTS FOR FLUORESCENT LUMINAIRES



Supporting the weight of a heavier fixture is only one of three important requirements for fluorescent luminaire brackets. The design must also be able to withstand 100 mile per hour wind velocities applied over a larger projected luminaire area as well as support the added seasonal weight of an increased snow- and ice-loading area.

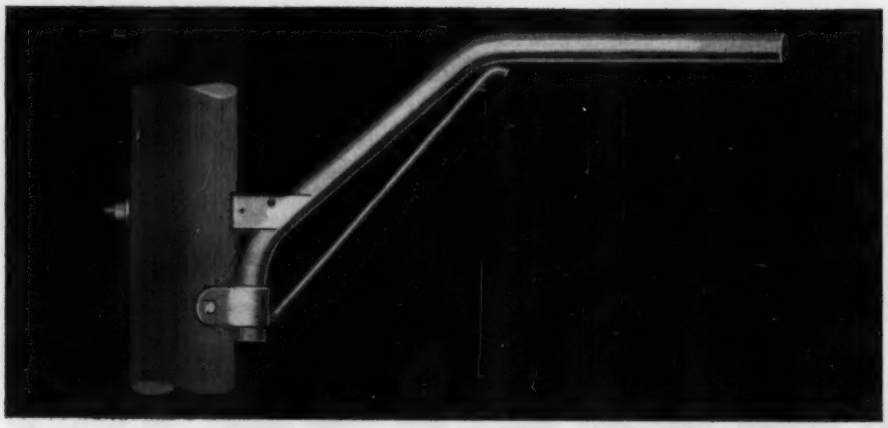
Not content with laboratory tests alone to indicate the importance of "weather factors," Hubbard and Company made field installations to subject various designs to actual service conditions. One of the early observations made during this testing was the conclusion that "heavied-up" models of brackets designed for mercury vapor and filament type fixtures do not make satisfactory supports for fluorescent luminaires. As a result of this testing, an entirely new line of Hubbard galvanized steel Street Lighting Brackets has been developed especially for fluorescent installations.

Write us for more information on the two designs shown, as well as a description of other styles available.

HUBBARD AND COMPANY

Pittsburgh 1, Pa. • Chicago, Ill. • Oakland, Calif. • Plano, Texas

"Dancing in the wind" has been eliminated by angle steel "tie rods" and specially designed bracing in new Hubbard designs. (Below) Stock No. 23032, for use with luminaires with a maximum projected area not to exceed 8 square feet. Extension from pole—4 feet. Rise—14 inches. (Above) Stock No. 23908, for use with luminaires with a maximum projected area not to exceed 8 square feet. Extension from pole—approximately 8 feet. Sizes to 20 feet.



Your Westinghouse representative can prove...

6 MAJOR TRANSFORMER IDENTIFICATION IMPROVEMENTS

Simplify selection, maintenance, inventory, load monitoring. New serial and style numbers on larger nameplate give complete transformer description instantly. Protective link and LV lead identification, new kva Vinyl-Cal and offset breaker handle identify 20% greater overload capacity . . . all measurable in operating dollars saved.

J-70795

YOU CAN BE SURE... IF IT'S

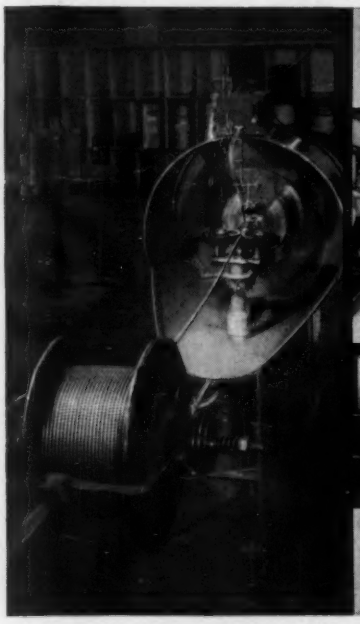
Westinghouse

F. T. Hausle, Distribution Design Engineer of Long Island Lighting Company, one of the three utilities who did experimental engineering and field load testing of both old and new Type CSP® transformers, agrees with Tom Oliver, Westinghouse representative, that "positive identification has always been significant in resolving operating, purchasing and engineering problems of transformer use."

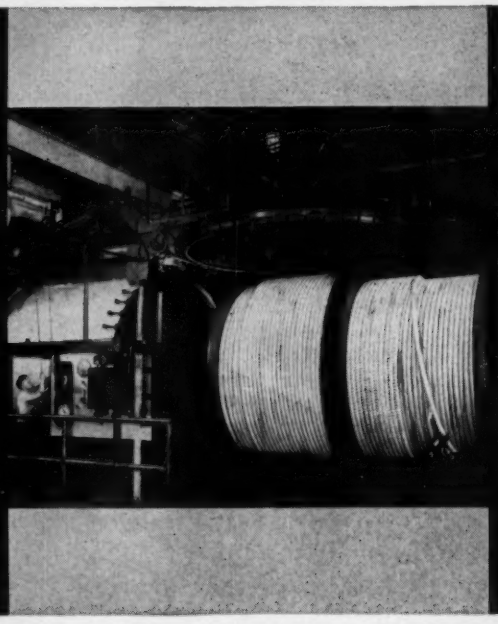
GENERAL CABLE

PAPER INSULATED
VERSATILE · RELIABLE
POWER CABLES

Manufactured at BAYONNE, N. J. • ST. LOUIS, MO. • EMERYVILLE, CALIF.



This machine forms steel strip into helical coil ducts or channels for use in gas filled or oil filled cable.



Impregnating Tank utilized in the heat-vacuum drying and oil impregnation steps in the manufacture of Paper Power Cable.

Large Cabling Machine used in cabling individually insulated conductors into multiple conductor assemblies.

- **SOLID TYPE**
- **LOW PRESSURE GAS FILLED**
- **LOW PRESSURE OIL FILLED**
- **PIPE TYPE**
  - **High Pressure Gas Filled**
  - **High Pressure Oil Filled**

The excellent operating record over many years and the superior electrical characteristics of paper insulated cable highly recommends its use for all power applications. Paper Power Cable is a predominant type in preference and use for voltages above 5 KV.

General Cable Corporation is equipped with the finest modern facilities for paper taping and with many years of know-how is in a position to supply a high quality product for all low and high voltage applications.

GENERAL CABLE CORPORATION
420 Lexington Avenue, New York 17, N. Y.
Offices and Distributing Centers Coast-to-Coast

for quality and economy... **specify GENERAL CABLE**

New HOMELITE Pump

Whispers While It Works

Goodby residential complaints! Here's a new lightweight gasoline engine driven pump that takes it easy on the neighbors' ears. Yet handles any water problem . . . from seepage to volumn pumping! The new Homelite Model 36 S2 2″ self priming centrifugal Pump operates at slow speed with low noise level yet has high capacity of 9000 gallons per hour. It weighs only 85 pounds and can be easily carried by one man to the best pumping location. Starts quickly, primes automatically, gives long, dependable and trouble-free service under the toughest conditions. Ask your Homelite Representative for a free demonstration. You'll find a good neighbor policy in every pump.

HOMELITE

A DIVISION OF TEXTRON INCORPORATED

6108 RIVERDALE AVENUE • PORT CHESTER, N. Y.

Why More Utilities Are Selecting L-M Type E Valve Arresters

L-M valve-type distribution lightning arresters have established an outstanding performance record by giving millions of service years of reliable protection. The Type E has been a leader in the field, and hundreds of thousands have been giving excellent service for many years. The failure rate is phenomenally low.

Here are some of the reasons for this remarkable record, and for the great increase in customer preference for the L-M Type E valve arrester.

Balanced Sparkover: Spark gap is a ladder-gap design, pre-set and then permanently sealed in the arrester housing. It cannot be knocked or burned out of adjustment. Gap is precision-made to assure optimum balance between 60-cycle sparkover and impulse sparkover.

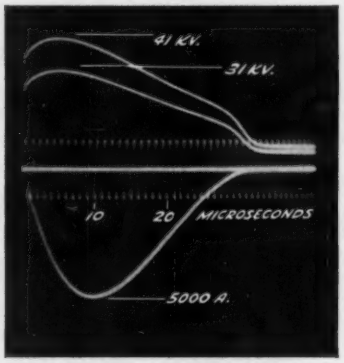
Low IR Drop: L-M now has a new Type E arrester, the E-3, which provides even lower IR drop than its popular predecessor. The new Type E-3 also provides greater durability and discharge capacity. These advantages are made possible because the new Type E-3 has an improved gap which provides greater 60-cycle interrupting ability, permitting reduction of the resistance of the valve element. The oscillogram shows the improvement in IR drop between the Type E and the new Type E-3.

Positive Protection: L-M valve arresters have a Pyrex glass housing which permits visual inspection of the spark gap in the field. Should the arrester become damaged, telltale evidence can be readily seen through the glass. If the arrester should fail to interrupt 60-cycle follow current for any reason whatsoever, L-M's patented Isolator provides positive assurance against grounding the feeder by disconnecting the ground lead from the arrester.

Other features include Zincilated (Zincilate No. 100) arrester housing clamp, fibre-glass cap, and fibre-form packaging. New packaging provides additional strength to the carton so arresters can be stacked easily on pallets.

Get Complete Information

Get the whole story of L-M arrester performance and application. Ask the L-M Field Engineer, or write for a copy of bulletin on the new Type E-3 arrester, to Line Material Industries, Milwaukee 1, Wisconsin.



Oscillogram shows reduction in discharge voltage in the new Type E-3 valve-type lightning arrester. Curves are for a 9 kv unit. IR drop has been reduced from 41 kv to 31 kv—a remarkable improvement in a unit that already has established an enviable performance record over many years' service.

LINE MATERIAL Industries

McGRAW-EDISON COMPANY

LM Lightning Arresters

McGRAW EDISON

Are Summer Capacity Reserves Too Low?

In the five weeks ending July 22 three of the largest utilities in the U. S. were compelled to curtail service under the impact of two three-day heat storms. The system circumstances surrounding each of these episodes were strikingly similar. They were sufficiently unique to suggest that prevailing practices with respect to reserve requirements and the scheduling of generating equipment outages for maintenance need to be re-examined.

On all three systems, blocks of generation ranging from 145 to 400 Mw were out of service for maintenance when sustained 90-to-100 degree weather sent air conditioning loads rocketing. The result in each case was heavier loading of in-service equipment, which in turn caused forced outages due to breakdown and eventual load curtailment as the margin of reserve capacity dwindled and disappeared.

Could it be true that hitherto adequate reserve margins were entirely insufficient to handle the sharply accelerated growth of air conditioning that caught the major metropolitan systems off guard during seasonable hot spells this year?

This highly temperature-sensitive load has brought load swings from peak day to minimum-load day this summer that have surprised veteran system operators. On one of the systems mentioned, for example, this swing was over 800 Mw against a 3,500 Mw peak compared with swings of around 500 Mw in previous years. Comparable swings for the other two systems were well over 600 Mw against peaks of 2,300 and 3,700 Mw.

Disappearance of the traditional summer valley, and the appearance of multiple summer peaks in its place, has compounded the problems of scheduling machine outages for maintenance. With winter peaks climbing too it leaves only a few weeks in spring and fall for routine inspection and repair.

These fundamental changes that are taking place today in the character of system load pose knotty problems which demand and will undoubtedly get the studied attention of management and engineers alike.

Meter Records – A Field for Automation

Automation today is playing a familiar and increasingly important role in utility customer and general accounting functions. Much has also been done in applying automation to inventory controls and to the processing of repetitive purchase requisitions. Its application to meter records appears to offer a further fruitful field which today has just been scratched.

The task of maintaining meter records is essentially a clerical one. It is voluminous, time consuming, and repetitive, as well as tedious. In similar functions in other fields, automation in record keeping has built a reputation for efficiency and economy.

Centralization of records is inherent in today's strong trend to automation in record keeping. To make it operative in the meter field without loss of adequate control over assigned functions, it is vital that metermen take a strong lead in this promising field and guide its organization. Few are in a better position to know what records are kept, which ones are of real value, and where the biggest savings are possible through the elimination of duplicate records.

Whether automation can be of real value in meter work, whether it can effect economies, save manpower, and do a better job depends on the ability of metermen to guide its application wisely.

JCAE Writes Construction Bill

If it becomes law:

- **PRDC will get only $1.5 million, not $4.2 million**
- **Private industry will get $50 million in help**
- **Government will build five "public power" reactors**
- **Arco will get 40,000-kw gas-cooled reactor**

The Congressional Joint Committee on Atomic Energy last week critically appraised the nation's civilian reactor program, and authorized a bill for construction. Here's what happend:

Public power partisans on the Democratic side of the committee —with Sen. Albert Gore (D-Tenn.) in the forefront—attempted to force down the throats of the reluctant Atomic Energy Commission an unpleasant dose of medicine: A federal reactor construction program for the benefit of public power co-ops and municipal power agencies.

Strauss Stands Firm

Political infighting over this first step was intense and behind locked doors. AEC Chairman Lewis L. Strauss, through his Republican defenders on the Joint Committee, was making a last-ditch stand.

In backing the first such itemized atomic construction program ever laid down in Congress, the Joint Committee:

- Directed AEC to build five power-producing reactors for the public, authorizing about $150 million for this.
- Authorized construction of a $40-million, 40,010-kw prototype gas-cooled reactor at the Arco National Reactor Testing Station.
- Authorized a $15-million, 15,000-kv, recycle plutonium-fueled experimental reactor.
- Recommended about $50 million for private industry assistance.

Industry Gets Aid

This assistance is in waivers on fuel-use charges, plus direct research and development aid. It applies to the Florida group of utilities, and the Mid-western group headed by Northern States Power Co, which has applied for a license to build a reactor near Minneapolis.

PRDC Hearings Hurt

AEC had sought in the hearings authority also to give $4.2 million of help to Power Reactor Development Co, a group headed by Detroit Edison Co, but the committee reduced that sum to $1.5 million—apparently because PRDC is now involved in a prolonged government hearing on charges that the design is hazardous.

Of the five reactors to be built for the public, four are for cooperatives; the fifth is for the City of Piqua, Ohio. They are:

- Consumers Public Power District of Nebraska, sodium-graphite reactor, 75,000 kw, upwards of $50 million.
- City of Piqua, organic-moderated reactor, 12,500 kw, $7.5 million.
- Wolverine Electric Cooperative, Big Rapids, Mich., aqueous homogeneous reactor, 10,000 kw, $5.4 million.
- Chugach Electric Assn, Anchorage, Alaska, natural uranium reactor, 10,000 kw, $15.8 million.
- Rural Cooperative Power Assn, Elk River, Minn., boiling water reactor, 22,000 kw, $8.4 million.

GORE: Gets a foot in the door

STRAUSS: Swallows bitter medicine

AEC at JCAE's Mercy

In this new situation, AEC is more or less at the mercy of the Joint Committee for the first time. Heretofore, AEC has by-passed the authorization process and has, instead, received lump-sum appropriations with no strings on spending.

But politically speaking, things have soured on Capitol Hill for Strauss. He has irked some potent Democrats—foremost among them crusty Clarence Cannon, chairman of the House Appropriations Committee. Cannon warned, in effect, that AEC must get itemized authorizations from the Joint Committee or risk points of order against appropriations — meaning no money.

AEC had been negotiating with local interests on all five projects. Strauss' idea was to have them built as partnership projects with title residing in the local interest. The committee said "No." The bill ordered that title should be vested in AEC.

Snake Dam Fight Moves Downstream

FPC examiner endorses Pacific Northwest Co's proposal for Mountain Sheep-Pleasant Valley dam: If confirmed, decision will thwart federal power groups

With private development of Hells Canyon assured, the question of whether the Middle Snake River in Idaho and Oregon also will be developed by private power companies is now in the lap of the Federal Power Commission.

Oral arguments are expected soon on Examiner Edward B. Marsh's recent decision recommending Pacific Northwest Power Co to be granted a 50-yr license for its proposed Mountain Sheep-Pleasant Valley hydro project.

Marsh feels the PNP proposal would best improve and develop "this stretch of the Snake River." He was unimpressed with public power and FPC arguments that the Middle Snake be reserved for a future high Nez Perce dam downstream from the PNP project.

If confirmed by FPC, the decision will be a near-final blow to federal power groups. They believe the Snake—regarded as the best undeveloped power source in the West—should be developed by the government.

The federal power block in Congress is seeing red on both the Hells Canyon rejection by the House Interior Committee and the Middle Snake events. Said Rep Al Ullman (D-Ore.), "It is high time Congress took it upon itself to reestablish its jurisdiction over development of the nation's interstate waterways."

Secretary of Interior Fred Seaton's reaction to Marsh's decision may hold the key to Mountain Sheep-Pleasant Valley development. He had written the FPC indicating a decision on Pacific Northwest's proposal be held off until completion of a study on the feasibility of a high federal dam at Pleasant Valley. If FPC upholds the examiner's report, legislation on the high dam is expected to be introduced. But its chances likely would be slim.

ATOMIC PROGRESS

AEA Pushes Calder Hall

Atomic Energy Authority relies more heavily on Calder Hall program due to gains in ceramic-fuel research, says report

The Calder Hall type reactor, originally planned as a stopgap, is expanding into a more permanent program, according to United Kingdom Atomic Energy Authority's annual report released July 25.

"It continues to show even greater potentialities than at first thought," stated Sir Edwin Plowden of AEA.

In the 40,000-word report, the Authority officially abandoned its "original concept of three successive stages" by which more advanced reactors were to be phased into the British atomic power program. Research will continue on four advanced systems, but the report expressed less certainty as to whether the sodium-cooled graphite reactor now has sufficient advantages over the Calder Hall gas-cooled type to warrant construction of a prototype.

Recent gains in ceramic-fuel research helped bring about AEA's change of plans. The Authority cites development of a cheap new way to produce high density uranium dioxide-ceramic fuel specimens to accurate dimensions in one operation. In the laboratory these specimens have remained stable at 2,000C under irradiation.

Highest priority will now go to pushing the ceramic-fuel program and fabricating beryllium canning material within the next few years. The objective is to raise fuel temperatures from 400C to 600C. This advance would up the output of a typical two-reactor station from 300 Mw to 800 Mw, increasing thermodynamic efficiency and thereby cutting capital costs.

Latest British research indicates that the carbon dioxide—graphite reaction will impose upper temperature limits on the Calder Hall type reactor.

NUCLEAR NOTES

Atomic construction contracts for first five months of 1957 ran 16% above 1956 figures. McGraw-Hill's "Construction Daily" cites more federal awards, but notes rising backlog of private jobs.

Orders for British nuclear power plants are worth twice those for U. S. plants, a London "Financial Times" survey shows. U. S. still leads in research reactors.

Britain's largest A-plant proposal now has official OK. Its two reactors are to produce 500 Mw by early 1960. Cost will run $168-million to $196 million.

AEC's H-power program, "Sherwood Project," includes unclassified research and development work with ultra-high vacuums by Westinghouse Electric Corp.

Young men are rising in Britain's atomic industry. D. A. J. Ballinger, who supervised Calder Hall "A" and "B" contracts, is now a director and department head at 35.

VEP Sets First Pole of 5,000

Here it is—the first of 5,000 poles to be set which will carry power into Vermont from the big St. Lawrence Project. This pole, at Castleton, is becoming part of a 115-kv transmission link with Vermont Electric Power system.

This line will become part of a new Vermont transmission grid which will carry 100,000 kw into the state. VEP has contracted with Vermont to build, operate, and maintain about 180 miles of transmission lines and nine new substations. The transmission company will be owned completely by Vermont's three largest utilities: Central Vermont Public Service Corp, Green Mountain Power Corp, and Citizens Utilities Co.

In the picture above, Frank A. Tucker, a Rutland, Vt., contractor (wearing hard hat and suit coat), supervises the "groundbreaking" operation. He is flanked by Albert A. Cree (pointing) and Harold L. Durgin. Cree is president of VEP; Durgin is executive vice-president.

FPC Reports 523.8 Mw Net Capacity Gain

PLANT ADDITIONS DURING MAY

State	Utility	Plant	Fuel	Capacity
Calif.	Southern California Edison Co	Redondo B	S	163,200
Minn.	Willmar Municipal Utilities Commission	Willmar	S	7,500
Neb.	Grand Island Water & Dept	Bischeld St	S	15,000
Ore.	U. S. Army Engineers	Dalles Dam	H	13,500
Utah	Bountiful Electric Dept	Bountiful	IC	1,000
Va.	Appalachian Electric Power Co	Glen Lyn	S	225,000
Va.	Potomac Electric Power Co	Potomac River	S	90,000
Wyo.	National Park Service	Canyon	IC	420

RETIREMENTS

Fla.	Municipal Light System of Chattahoochee	Chattahoochee	IC	270
Ill.	Produce Terminal Corp	Chicago	S	26,500
Ill.	Produce Terminal Corp	Chicago	IC	2,250
Ore.	Idaho Power Co	Oxbow	H	2,880
Tex.	Brownfield Municipal Light Dept	Brownfield	IC	350
Utah	Bountiful Electric Dept	Bountiful	IC	50

U. S.	Hydro	Steam	IC	Total
Added	13,500	500,700	1,420	515,620
Retired	2,880	26,500	2,920	32,300
Adjustments Plus	8,000	11,000	38,468	57,468
Adjustments Minus	8,100	5,850	3,033	16,983
Net Change	10,520	479,350	33,935	523,805

H—Hydro, S—Steam, IC—Internal Combustion

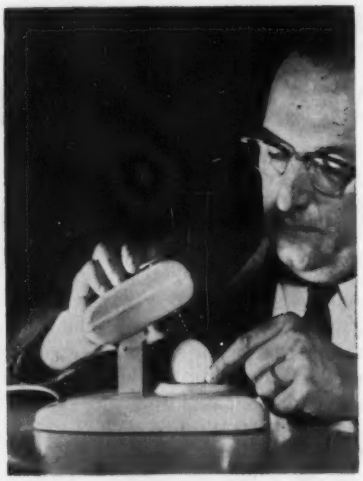
United States Capacity as of June 1—Hydro, 26,216,579 kw; Steam, 94,103,097 kw; IC, 2,474,954 kw; Total, 122,794,630 kw.

Oklahoma's Gary

. . . says REA's dream of taking over "whole power system"

Oklahoma's Gov Raymond Gary spoke out bitterly against rural electric co-operatives recently charging generally that they dream "to take over the whole power system, not only of Oklahoma but of the whole country." Specifically, he charged Oklahoma RECA with trying to stymie a Grand River Dam Authority-Public Service Co power contract. The contract would pave the way toward construction of the Markham Ferry dam power-boosting project.

Floyd Gibson, an official of Oklahoma RECA, charged the governor with "paying off a political debt" to Public Service Co by pressuring the authority into supporting the contract.



New Egg Beater Invented

Displayed at the First International Gadget Show held recently in New York, this electric egg beater mixes an egg's white and yellow inside the shell. Inventor Deane Harper of Dunbar, W. Va., said the needle is pressed into the shell while the egg is held in a foam rubber cup. As beating is done without air, the egg's innards emerge as a uniform liquid "more digestible" than when eggs are beaten the old-fashioned way, he said.

Meet Larry Nichols Superior WL&P's Soft-Spoken Skipper

He is a man with a penchant for boats, trout, and service to the public. He played a vigorous role while rising to the top through sales work

Superior Water, Light & Power Co has a new skipper—a man with a penchant for boats and "home-caught" Brule River trout. Superior WL&P's new captain is Lawrence A. Nichols who rose through the sales department to president and director of his company.

Nichols is a soft-spoken man with a keen mind for serious thought. Reflecting on 27 years of utility experience, he observed:

His Business Philosophy

"Every business and every department in a business is organized for a purpose. The objective of a business should be to produce more and better products or services for more and more people to enjoy so that they may live better."

This is one of his fundamental philosophies. Since he was a boy in Superior, Nichols has watched electric power grow into one of the mightiest forces in industrial America and become the housewife's cheapest source of domestic help. So Nichols finds plenty of opportunity in the utility business to apply this personal belief of his.

Works in Customer's Interest

Like many other vigorous utility men, Nichols always has sought to further the mutual interests of the customer and the utility. In his particular case, he played this role while rising through the sales ranks to the presidency.

Now at the top, Nichols views the future optimistically—especially with respect to the Head-of-the-Lakes region served by Superior WL&P. The signs are all optimistic, he points out in his soft-spoken way. The taconite industry is developing, the St. Lawrence Seaway project is moving along, and industry in general is trending toward diversification—which is contributing to the industrial development of the Midwest. Furthermore, Nichols cites the belief that a natural gas supply possibly may be found in the area soon, and this may stimulate further industrial growth.

"The outlook for the electric utility business is very bright," he said, speaking generally. "Power consumption is doubling about every ten years. And more labor-saving devices are being used daily. We constantly must look and plan for the future so that our services will be available when customers require them," he said.

Likens Utility to Individual

Nichols believes an electric utility is much like an individual—it has hopes, standards, and goals to be achieved. It is keenly sensitive and responsive to community needs—many of them challenging but rewarding when fulfilled.

This, then, may give some insight into the man who will help steer Superior WL&P in the future.

A native of Superior, Nichols attended Superior public schools and Superior State College. He then went to Washington, D. C., and worked toward a bachelor's degree at George Washington University.

Upon graduation in 1930, he went to work with the Wisconsin Valley Electric Co of Wausau, Wis., as an accountant. Two years after, he resigned to enter sales work. He joined Lake Superior District Power Co in Ironwood, Mich. The following year he transferred to Ashland Wis., and entered commercial sales.

Was Lt. Commander

Nichols has been employed by the Superior firm continuously since 1935—except for three war years when he served as a lieutenant commander in the U. S. Naval Reserve.

While moving toward the top, Nichols has been a sales engineer, supervisor of residential sales, industrial sales engineer, supervisor of commercial and industrial sales, general sales supervisor, and general sales manager.

In 1951 he was elected to Superior WL&P's board of directors. The next year he was elected vice-president and general sales manager. In May of 1956 he was elected vice-president and general manager. He was named president last May.

Fishes for Trout

Nichols has a family cottage on the Brule River which enjoys immense popularity in the summertime. He retreats there with his wife and two children (13-year-old Kay and 5-year-old Scott) to enjoy himself and perhaps fish a little for trout.

Among other sports, he likes hunting, canoeing, sailing, and curling—a game of Scotch ancestry in which heavy weights are skidded over ice toward a bull's eye. This love of sports spills over into his business environment. Visitors will find the walls of his office decorated tastefully with pictures of Brule River scenes and sketches of hunters and fishermen.

How to Skirt the 'Non-Callable' Clause

- **You can pay the usual 5% redemption premium plus an extra premium covering profit on redeemed bonds but . . .**
- **You should first present it to the regulatory bodies to see how they will rule on this redemption program**

Is there a way around the non-callable clauses that investors are demanding in bond contracts these days? This clause, usually effective during the first five years of a new bond issue, prevents the company from redeeming high-interest bonds and putting out a low-cost issue as money costs drop.

Redemption of bonds for interest saving has been quite a common occurrence among electric utilities.

They have come when interest rates declined sharply, usually after first rising to relatively high levels.

In the fall and winter of 1953-54 interest rates turned drastically downward, following the rapid rise of the preceding spring. Then many electric utilities found it profitable to redeem their recently issued bonds. Some of these had been outstanding less than a year. The decline in interest at that time ran to fully 1% per annum, many times the cost of redemption.

Must the issuing company either pay higher interest rates now and retain its redemption rights, or, in the alternative, forego its redemption rights for five years? Here is an answer.

A provision can be made in the new bonds that if they should be redeemed within five years (for purpose of interest saving) the company would pay the bondholders:

- Not only the basic redemption premium of around 5% but,
- An additional premium representing a percentage of principal which would constitute a share in the savings received by the company from a refunding operation.

Pass Saving to Bondholder

It would seem advantageous to the issuing electric utility to give the bondholders a reasonable share of its saving from refunding rather than be prohibited entirely from profiting by redeeming its bonds.

When a refunding occurs, the utility now pays the basic premium immediately and recovers it (plus the net saving of the refunding) by virtue of reduced interest spread over the life of the new bonds.

The same principle could apply to additional premium designed to represent a share in the profit from refunding. Therefore, the loss to

Here's How Bond-Redemption Profits Would Work . . .

Let's assume the original bonds were sold at a 4.75% yield. The new refunding bonds went at 3.50%. Gross savings would run 1.25% a year.

This percentage applied to the principal amount of the outstanding issue over its remaining life would represent a sum, which, divided by the principal of the outstanding issue would constitute the total gross profit from the refunding.

Expressed in dollars and applied to a $10 million outstanding bond issue, with an original 30-year life, refunded after three years, the annual saving would be $125,000 gross; multiplied by the remaining life of 27 years (earlier average maturity through operation of conventional sinking fund might be disregarded for the purposes of simplicity) this would amount to $3,375,000 of gross profit, or 33¾% of the principal of the issue. However, 5% of principal should be immediately deducted on account of the basic premium, leaving 28¾% of principal as net profit before company expense.

In determining the respective shares, the factor of loss of use of the money to the company should be reflected (for 13½ years in this case), as well as the company's expenses in the refunding operation other than the basic premium.

If 33⅓% were arbitrarily selected as a fair proportion of net saving to accrue to the bondholders (leaving 66⅔% for the company) we find this portion of 28.75% equals 9.58%.

From this percentage there should be deducted, first, an allowance for company expense (let's assume this to be ⅓ of one half of one percent of principal or 0.17%, leaving a net of 9.41%; next this percentage should be discounted to reflect the present value of a like amount received in equal instalments over a 27-year period, the equivalent of such amount being received 13½ years hence.

Allowing a minimum overall money cost to the company of 5%, such present value would be about 52%, which would reduce the 9.41% to a net of 4.89% of principal.

Under this computation, the additional premium would be about 4.89% of principal, which might for convenience be rounded out to 5%. In such event the total redemption premium payable to the bondholders upon the refunding would be 10% of principal. This consists of 5% of basic premium and of 5% of additional premium representing 33⅓% of the net profits from the refunding.

As the basic premium was reduced by the passage of time, as provided under conventional indenture provisions, the amount deducted from the gross percentage refunding profit to arrive at the net profit under this formula, could be accordingly reduced.

the issuer of the use of funds to pay such premium, over a period equal to half the life of new refunding bonds, should be considered as a factor in determining the share in the profit which the company and the bondholders should respectively receive.

Negotiate Profit Split

Just how this profit should be divided could be readily fixed by negotiations between the issuer and the purchasing institution in the case of privately placed financing.

As to public financing, the underwriting firms who are in touch with and aware of the desires and current requirements of the prospective institutional purchasers could advise the company as to a desirable division of profit.

At first this division might vary considerably as between different companies, but once the principle is accepted and reflected in any considerable portion of new offerings, a profit-sharing formula would no doubt develop which would be generally applicable to new financing where this procedure was used.

How the Federal Power Commission or the state regulatory bodies will view profit-sharing on redemption can best be determined by asking them to consider it.

However, it seems not unlikely they would be favorably inclined toward the basic principle since it would permit those companies needing immediate minimum interest on new issues to obtain lower interest without sacrificing their right to profit from a refunding within the initial five-year period.

Some May Choose Alternative

Many utilities not so greatly in need of immediate benefit from lower interest on their new bond offerings might be willing to obtain such lower interest by a profit-sharing arrangement on redemption, rather than to give up completely their right of redemption for the first five years, which might prove extremely costly if circumstances worked out unfortunately for the issuing company over the years.

The profit from the refunding should be readily computable by first determining the excess of interest yield at which the bonds being redeemed were originally sold by the issuing company over the interest yield at which the company sold the new refunding bonds.

How the profits from bond redemptions would work is shown in the accompanying box.

The suggestion that corporations share their refunding profit with their bondholders is designed as an alternative to a complete prohibition of redemption for a limited (five year) period. Therefore it should become effective only during the period when the prohibition would otherwise have operated. Thereafter the company would be free to refund its bonds and keep the saving.

Hold Out If You Can

Since the profit-sharing feature would be limited as to time, it would obviously be to the advantage of the utility to defer a refunding until after this period expired so it could retain the entire savings from the refunding.

Under present critical conditions in the utility bond market, a proposal along these lines seems to merit careful consideration both by the managements of issuing utilities and the responsible executives of the principal purchasing institutions. In addition, it should deserve thorough scrutiny by underwriters.

Historical Foundation Inventory Progresses

The program to preserve relics of electrical pioneering moved ahead as the board of trustees of the Electrical Historical Foundation met in Norwalk, Conn., July 12.

The board allocated funds to continue its inventory of documents and objects significant to the industry's history. They planned to expand the board to make it more representative of groups interested in the industry's progress, and set up membership classifications.

Westinghouse Electric Corp became the third sustaining member of the foundation with a $1,000 contribution. Other classifications are contributing member, $100; and associate member, $10.

The meeting was held in the Burndy Library, a repository of scientific source material which includes the first electrical "text"—published in 1600.

BEN FRANKLIN reported his famous kite experiment in this book. Electrical Historical Foundation trustees examine Burndy Library relics at board meeting

Study of This Tame Bird . . . and Damage Her Kin Causes . . .

Utilities Try Chemical Tactics

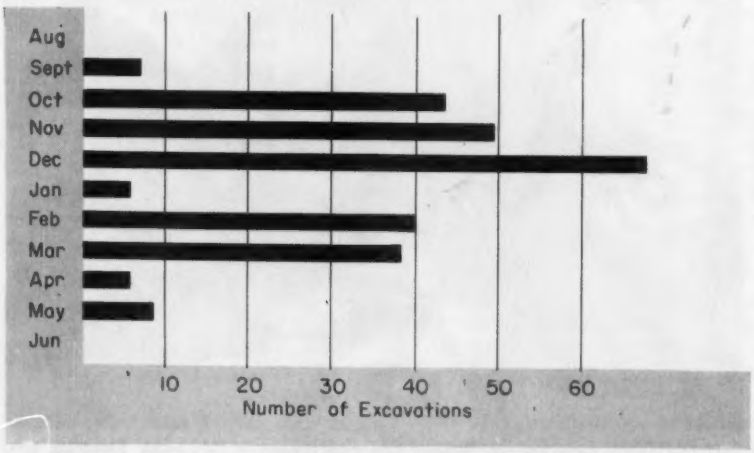
Hardy transmission men ordinarily possess a love of the outdoors and the woodland creatures therein. But when it comes to kin of the beady eyed female above, these high-voltage men generate a molar-grinding-type charge.

The accompanying photos tell why. Those pock marks, gaping checks, and soccer-ball holes are trade marks gouged in electric utility poles in the Northeast by pileated woodpeckers. This species or its needle-nosed cousins wages war on wood structures of systems throughout the U. S. And observers of peckerology agree that the pileated peckers' population is flying up.

"No studies have been made so far as we know," says an Audubon Society spokesman, "but they definitely have increased considerably."

A variety of theories exist on why the birds pick on utility poles, most of which are bathed in preservatives and, consequently, shelter no insects. Some say pole resonance matches that of dead trees. Birds like to hammer away on 'em just for the sound effects, these students add. Maybe it's a mating call, according to other bird watchers.

An even wider range of ideas have been suggested to thwart the costly attacks. "Paint phoney holes to encourage a woodland retreat"; "Wind cap pistol ammunition around the poles"; or "Attach drums with superior resonance": These are some fringe proposals.



HEAVIEST PECKING DAMAGE might be cut by use of short-term repellents

Solution of the problem stands its best chance of success at Pennsylvania State University. A three-year research project there sponsored by four power companies is past the half-way point in the search for the best pecker deterrent. (EW, June 20, 1955 p 24).

The researchers' most promising findings owe much to the nameless bird illustrated here. She's the first *Dryocopus Pileatus* raised in forest-like conditions after reaching maturity. And her aversion to chemicals daubed on decayed, insect-laden red pine posts propped in her aviary has helped track down potentially effective repellents.

Pecker-Proof Poles — They Hope

Sponsors hope field test applications of six out of the 75 compounds tested will produce pecker-proof poles. But "effectiveness of these chemicals in repelling woodpecker damage can't be evaluated until next spring," observes D. A. Campbell, Jr, general superintendent of Pennsylvania Power & Light Co. "We'll have to wait and see what happens in heavy damage periods."

Other participants—New Jersey Power & Light Co, West Penn Power Co, and Northern Pennsylvania Power Co (now merged with Pennsylvania Electric Co)—have or are currently treating section of H-frame or single transmission pole lines in remote forested areas, where the most destructive drilling occurs.

. . . Is Leading to an End . . . of This Havoc . . . on Power Poles

to Squelch Pileated Pecker Plague

Big question with chemical treatment is the lasting properties, says Dr Richard N. Jorgensen, Penn State's assistant professor of wood technology. But if preparations weather off in, say, six months, there's still cause for optimism. In field observations Dr Jorgensen and his associates discovered serious damage to poles was limited to six months, October to March.

"This . . . means it is possible that emergency treatment of the poles by a temporary or short-term repellent, which would be less expensive than pole replacement, may be used over the fall and winter seasons until more permanent repellent materials can be found," states a project report.

Mixed Bath Is Long-Range Aim

The utilities are looking ahead to long-range prospects, too. If some chemicals squelch the pecking plague until spring, sponsors can arrange a simultaneous chemical and preservative bath for poles.

"For this, it'll take about ten years to see where we really stand," says a participating company's man. Current field tests will confirm the aviary findings, he believes.

"What a fella really needs," says another transmission man, "is some woodpecker psychology." He thinks the solution "may be so simple we'll wonder why we never thought of it before."

Some testing involves poles treated with Greensalt (chromium copper arsenic) and autoclaved copper formate. The tame bird avoided wood treated with these compounds. The "sickly green" hue of the preservatives, he theorizes, may be enough to discourage attack, although previous tests with white, red, green, and yellow colors didn't dull the birds' passion for pecking.

The chemicals won't kill the birds. It's believed the compounds repel by odor. If preparations even make the peckers sick, utilities will hear from the Audubon Society, which is following the field work closely. U. S. regulations call for fines of $500 a bird if authorities catch hunters shooting the birds.

There are no estimates on what U. S. utilities pay to prevent pecking, pack the pole holes, or replace ventilated transmission structures. But for Pennsylvania P&L, here's the scope of the drilling devastation:

Damage Costs Mount

"From 1950 a total of 1,000 poles have been under attack on our system. About 6% of these require replacement annually," says Campbell. Yearly cost of replacements has mounted steadily, he ruefully adds, because more poles are being excavated and average life of these poles is decreasing.

"We're not doing any woodpecker accounting yet," notes one neighbor of Campbell's, "but we do have lines that are taking a lot of damage." Says another: "Every time you replace a 132-kv line pole way the hell and gone up in the mountains you're not going to get much change from a $1,000 bill."

Other Penn State findings:

Poles must be protected from ground line to cross arms and in all directions.

Line sections with serious damage are usually surrounded by a hardwood forest type vegetation interspersed with conifers. Damage occurs both along stream bottoms and on higher plateaus.

Attacks Less in Old Forests

Mature forests with plenty of stumps, decayed logs, and standing dead trees offer good woodpecker foraging and nesting. Utility poles nearby are apt to experience fewer attacks with these conditions.

A few mechanical devices were judged "satisfactory" in protecting wood in the aviary. But sponsoring utilities feel the devices won't offer practical solutions under present maintenance.

Here are chemicals undergoing test and firms that make them: Rosin Amine D Pentachlorophenate, Hercules Powder Co; 1,3 Dibutylthiourea, Sharples Chemical Penn Salt Mfg Co; 3-Nitro-4-Aminoanisole, 4-Nitro-2-Aminotolulene, 2-Naphthylmercapto Acidic Acid, Du Pone Chemical Co; MSG-1.1 N,N,N' = Diodecyldithiooxamide, Mallinckrodt Chemical Works.

2 Utilities Want Navy Base

Mississippi Power Co and East Mississippi Electric Power Assn of Meridian are vying for the load being created north of Meridian by a $45-million, 2,500-man jet airplane base now being built there for the U. S. Navy. About 160 planes will be stationed at the base.

Both the co-op and the private utility claim "grandfather" rights, the vested interest given utilities in areas they served when the 1956 Public Power Act became effective. Both MPC and EMEP had lines in the area.

MPC claims it is "the only utility qualified by reason of its capacity, ready availability, its experience, and personnel" to serve the base adequately. But the co-op applied to the Public Service Commission for permission to serve the base several months before MPC did. Observers predict a public hearing almost certainly will be scheduled before the PSC hands down a decision.

EEI to Accept Affiliates

Edison Electric Institute has amended its constitution to extend affiliate membership to privately controlled electric utilities in the Western Hemisphere. Affiliate members must pay dues and accept privileges and conditions of membership as prescribed by EEI's board of directors. Affiliates will have no voting rights.

Argentina Squeezes A&FP

American & Foreign Power has been caught in another squeeze. Its Argentine subsidiary Compania de Electricidad del Este Argentina S.A. has called for official, physical protection of its plant and personnel in Gualeguaychu against mob violence.

McGraw-Hill World News reports the trouble began with a recent rate increase authorized by the city council of that town. A self-styled Comision Popular (people's committee) composed, according to company spoksmen, entirely of members of the Communist Party with one sole exception, began to agitate against payment of the rate increases.

Finally a group of demonstrators attempted to storm the Municipal Building, and later the headquarters of the power company. In each case, police prevented the group from entering. The city council annulled the rate increases.

This is the latest of many troubles A&FP subdidiaries have encountered in Argentina. About 47% of the company's holdings were expropriated under Peron or before. The present provisional government has promised to settle the company's claim for payment for these expropriations, but so far no arrangements have been made. On the contrary, two new expropriations by local authorities have taken place since Peron's regime fell.

Russia Paces U. S.

Russia's electrical development "is on a par with our own in size and equipment," said Irving R. Smith, manager of Westinghouse Electric Corp's Rectifier Engineering Division in Buffalo, N. Y. One of 24 U. S. delegates to the International Electrotechnical Commission held in Moscow this year, Smith said that Russia "is ahead of everybody else" in the transmission of high-voltage direct current—pointing out that it is generally more practical to transmit alternating current in the U. S.

Setting Equipment Prices

I-T-E Circuit Breaker Co said last week it plans to adopt a new price-setting policy "wherever practicable" for equipment bought for delivery at an extended date. Prices will be based on published government indexes for labor and material. When a customer places an order, he is to be advised of the index levels at that time. By watching these indexes, he can judge more precisely what the price will be when the item is delivered.

The escalation policy now being scrapped is based on "price at time of shipment." Administered by the manufacturer, it is not applicable to today's market conditions, the company stated.

The company also announced 2% to 7% increases in prices of high-voltage switchgear, high-voltage unit substations, isolated phase bus, and power switching equipment.

Hydroelectric Hostesses

Sweden's State Power Board is providing hostesses at its big tourist-attracting hydroelectric plants, it is reported. The 100 hostesses are wives of Board employees and serve without pay. Wearing crisp blue uniforms they guide visitors and distribute brochures.

Black Night in Carlinville

Hundreds of Carlinville, Ill., residents turned out one evening recently to watch Mayor B. G. Bates turn on the new "white way" in the business district. But because of line trouble, the "white way" remained black when Bates threw the switch.

Said Ralph Rutherford, local power company manager, "I've had many disappointments in my life, but none overshadowed this."

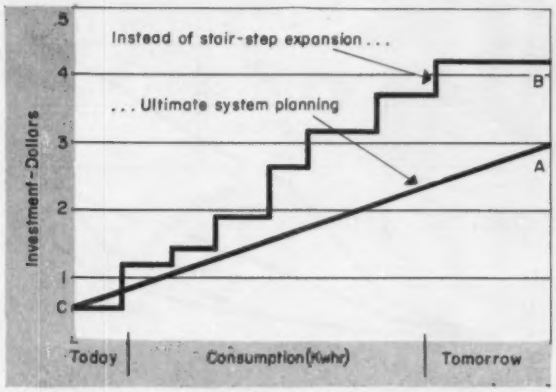


FIG 1—STUDY comparing consumption with investment shows long-range plans save more than step-by-step growth

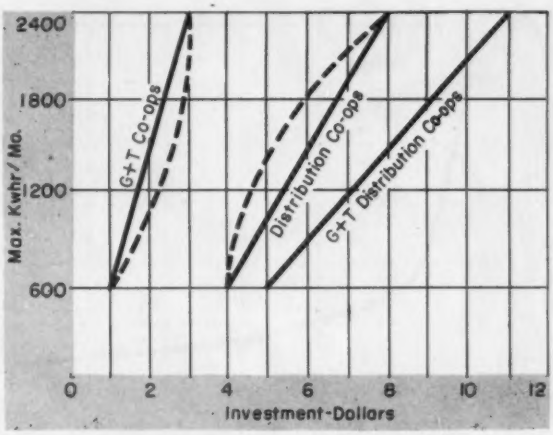


FIG 2—INVESTMENT varies with use per customer, a relationship favoring long-range planning by distribution co-ops

Rising Use Permits Rates to Fall

South Dakota co-operatives find they can deliver four times as much power as customers now use for only double the present expenditure

South Dakota's rural electric co-operatives have been conducting studies directed at a reduction of rates and development of system plans that will make lower rates possible. So far, the studies indicate that the best way to get rates down is to get use up. Cost-of-servicing figures show that the co-ops can deliver four times as much power as customers now use at double the present cost to the co-ops.

Spearheading the activity are East River Rural Electric Power Cooperative, a transmission co-op with headquarters at Madison, and the South Dakota Rural Electric Association. Some of the philosophy and findings of these studies have been summarized for Electrical World by V. T. Hanlon, East River's manager, and V. H. Herriott, manager, Sioux Valley Empire Electric Association and chairman of Statewide Rate Study Committee.

Need Seen for Long-Range Plan

Although the studies began with the rate study, it soon became apparent that a long-range system plan would be necessary to back up any decision on rates. As most distribution cooperatives are making rate studies, data were readily available on the number of consumers per township and the kilowatt-hours per customer per month for each town.

Before much progress was made, it was decided that the system should be planned to provide service to all-electric farms. Available farm and farm home equipment was studied, together with kwhr use of each. This analysis indicated that the all-electric farm would have an annual use of at least 24,000 to 30,000 kwhr/customer/year. Plans therefore were based on facilities for the greater number.

Substation Size Determined

First step in the long-range plan was to determine substation sizes and locations and transmission line routes. Transmission lines are 69 kv, feeding from the Bureau of Reclamation's 115-kv transmission system. Distribution plans provided for 7.2/12.5-kv feeders. Designs were based on a maximum 7% voltage drop to the customer.

A random area was chosen, and a plan was developed to serve it. To meet design requirements, substations were spaced 12 miles apart. A distribution system was designed with four feeders from each substation, laid out in the form of a swastika. The long-range plan provides for three to five feeders per substation.

From curves provided by REA, coincident demand was calculated at 7.92 kw per customer. From this, required substation size was determined to be 2,000 kva. Calculations were based on a customer density of two per mile. Lesser densities were also studied. Plans call for substations ranging from 1,000 to 2,500 kva in capacity.

3-Phase Service Forms Base

Plans were based on area coverage to make available 3-phase service so that the farmer could make use of electric power for farm requirements that could not be met satisfactorily with single-phase supply.

The plan showed that in the long run it would be cheaper to build toward the ultimate system than to follow the step-by-step approach. According to calculations, the investment ratio under such a plan changes between the generation and transmission co-ops on the one hand, and the distribution co-op on the other. More distribution investment would be deferred by building transmission and substation facilities on an accelerated schedule. Thus the combined investments could be kept optimum. These were estimated at $5 for present use of 600 kwhr/customer/month and $11 for 2,400 kwhr/customer/month.

When a constant cost of 8.88 mills per kwhr is assumed, the ratio of distribution to power supply costs

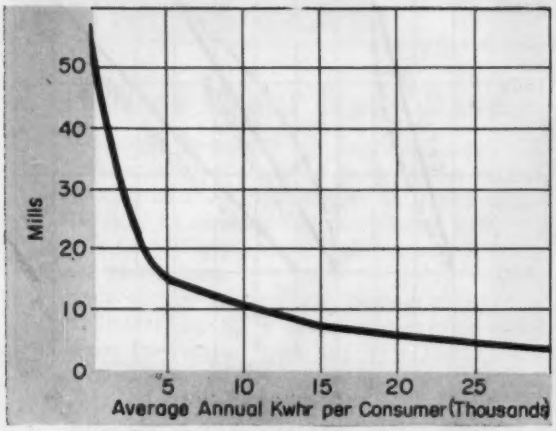


FIG 3—DISTRIBUTION COSTS favor system expansion to provide for greater customer average annual kwhr consumption

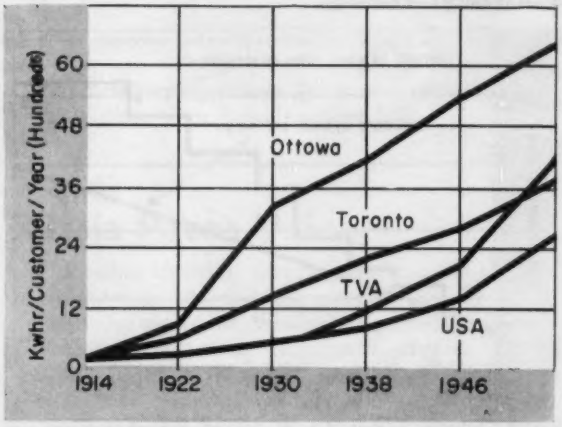


FIG 4—CUSTOMER USE took an upward trend in areas where promotional rates were introduced, as in Ottawa, Toronto

varies as 60 to 40% for 6,000 kwhr, and 36 to 64% for 30,000 kwhr average annual use. The studies showed that voltage drop could not be reduced economically by increasing conductor size, but rather by making substation areas smaller and multiphasing existing lines. Voltage regulators could defer transmission and substation investment. Plans provide for assuring high service reliability by developing loop transmission feeds as rapidly as practicable, and at least one 3-phase feeder tie from one substation to the next.

The effect of promotional rates in other areas was also studied. The sharp upturn in kwhr use in Ottawa, Toronto, and the TVA areas are believed to reflect very low promotional rates. Whether large increases in customer use require equivalent increases in service costs was investigated, and found not to be the case. Costs for providing service to customers having an average use of 6,000 kwhr/customer/year as compared with costs with a use of 30,000 kwhr/customer/year are shown in Fig. 3. These are based on a wholesale power cost of 8.88 mills per kwhr.

Two Questions Remain

The questions that remain are: Will increased use of electric service make reduced, or promotional, rates economically sound?

Will it be necessary to establish a very low promotional rate to develop the increased use and, if so, can the cooperatives be kept on a financially sound basis during the load-growth period?

But, regardless of the answers, the long-range plan has been worthwhile. Approximate cost of the studies was $100,000, said Hanlon, and already it is apparent that more than this will be saved in a very short time through reduced costs for transmission lines and substations and reductions in obsolescence and system changes.

Interstate's R/W Field Procurement Pays Off

A sound public relations foundation, rights-of-way buyers wise in the ways of farming, and fair negotiations in the field help Interstate Power Co procure easements quickly and amicably.

As a measure of the company's success, there have been no condemnations since 1949, says C. W. Luckritz, land and tax agent. He cites these negotiation results:

- About 92% of the people make a deal for R/W on first contact.
- Another 5% are somewhat reluctant but negotiate without much difficulty.
- Remaining 3% hold out almost to the point of litigation, but negotiations are closed without condemnation.

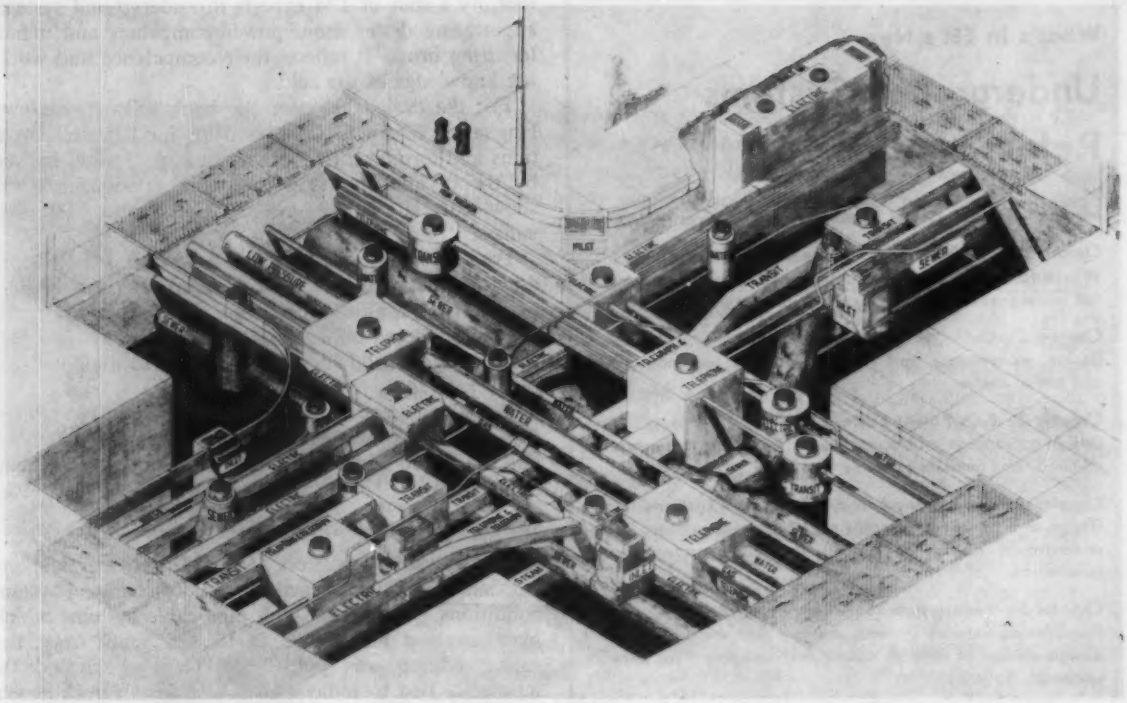
Interstate's first step—one of the most important—has been the development of a good public relations program in every nook and corner of its territory. Then, men are selected who have the right personality for buying R/W. Having rural backgrounds, they can deal with farm people. And this pays off in negotiating with farm couples.

Agents Get Full Story

When the time comes to procure R/W, the complete story of the project, including purpose of the line, is given to the men who contact property owners and negotiate easements. Procurement is based on equal payment per pole and anchor encroachment on each piece of property. Exceptions are made only when there are special conditions and more than the usual damage to property.

In the field, right-of-way men, in conjunction with construction engineers, work out conflicts with the property owners. This is done to locate the line so as to accommodate property owners' wishes in so far as practicable.

And, adds Luckritz, field men carefully maintain the main foundation—good public relations.



Underground structures at metropolitan intersection, from underground reference book chapter on conduit and manholes

New EEI Book is Basic Reference for . . .

Today's Underground Power Systems

- **Planned as a field office guide to the design, construction, operation and maintenance of underground power cable systems**
- **Compiled and written by 134 industry engineering authorities it includes underground standards and practices of 34 utilities**
- **Springing from the 1931 edition of the NELA Underground Reference Book it encompasses over a half century of underground engineering development**

Over fifty years of accumulated engineering knowledge and experience in the design, construction, operation, and maintenance of underground power systems has been packaged in a new field and office reference for engineers.

Underground Systems Reference Book, 2nd Edition. **Published by the Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y. 624 pages, illustrated. Price $12.50. Quantity prices on request.**

Published this week by the Edison Electric Institute it is the first new edition of the Underground Systems Reference Book to appear since 1931.

For all practical purposes it is a brand new volume. It bears little resemblance, except in title and some of the history it contains, to the original work first published 26 years ago by the old National Electric Light Association. The text is entirely new and has twice the content of the original volume.

A Working Reference for Engineers

It is essentially a working reference written by engineers *for* engineers. The approach to the business of designing, building, and operating underground power systems is straightforward, factual, and technical. It is thorough almost to a fault. An occasional reader may conclude that some of the detail is unessential. But in a reference work, as in engineering, extra thoroughness is seldom wasted.

In all chapters theory and practice have been carefully balanced to impart the essentials of engineering know how in all significant areas. The basic design principles and construction and operating techniques in which the book deals have been proved by a half-century of power system experience.

The book has been assembled and sharpened, as a

What's In EEI's New . . .

Underground Systems Reference Book

Introduction—**History of Underground Power Systems**

Chapter 1—**Applications of Cable and Cable Systems**
Why adopt underground construction, how avoid expense of full underground construction, types and selection of systems.

Chapter 2—**Cable and Cable Insulation**
Design, manufacture and specification tests for underground and aerial cable.

Chapter 3—**Bulk Power Systems**
Design construction and operation of pipe-type, low-pressure, oil-filled, and medium-pressure, gas-filled cable systems.

Chapter 4—**Underground Radial and Loop Systems**
Design and operation of cable subtransmission systems. Radial underground distribution systems for cities, residential and rural areas.

Chapter 5—**Underground Secondary Networks**
Principles of network systems, primary and secondary system design, design of network vaults, and equipment for network systems.

Chapter 6—**Street Lighting Systems**
Series and multiple systems, merits of each and methods of street lighting control. Poles and bracket types.

Chapter 7—**Conduits and Manholes**
Conduit system design and construction. Design of manholes, service boxes, vaults and pits; construction methods and equipment.

Chapter 8—**Cable Installation**
Installation and withdrawal of cable in ducts. Pulling, rodding and duct-cleaning equipment. Arrangement, support of cable in manholes.

Chapter 9—**Cable Joints and Terminations**
Joint and termination design from practical and theoretical angles. Tests and installation for typical joints and terminals.

Chapter 10—**Cable and Underground Equipment Loading**
Thermal limitations of buried cable, cable in ducts and pipe cable systems. Calculations of thermal and electrical characteristics are completely covered.

Chapter 11—**Cable Testing, Fault Location and Cable Identification**
Methods of fault location by terminal measurement and tracer methods. Cable and phase identification equipment described.

Chapter 12—**Records, Repairs and Maintenance**
Record systems. Inspection practices, maintenance and repair methods for conduit and cable systems.

Chapter 13—**Cable and Equipment Reconditioning**
Cable salvage, duct splicing, and reconditioning of underground equipment and transformers.

Chapter 14—**Corrosion**
Causes and results of corrosion. Tests to determine corrosion conditions, corrosion surveys, tests and mitigation methods.

Chapter 15—**Safety Practices**
Safety organization, work area protection, protection from harmful gases, protective equipment, fire fighting, first aid, etc.

tool, by a staff of 134 experts in underground systems engineering drawn from power companies and manufacturing firms. It reflects their competence and working knowledge of the field.

For the design engineer the book talks in his own language. Where there is need for fundamental equations and formulas, they are there in profusion, backed by theory and charts to bring out relationships and show correlation between calculated and measured values.

For the operator of underground systems the editors drew on the standards, specifications, and instructions of 34 U. S. utilities with large underground systems. Surveys gathered information where it was scarce. Results were consolidated, interpreted, and tabulated for ready reference.

For the construction engineer tools and practices common to the best modern procedures are explained and illustrated with drawings and field photos of actual applications.

System Conditions Changing

Power system engineers will read particular sections with an interest sharpened by rapidly changing system conditions. One deals with pipe-cable systems which have attained acceptance in the 26 years since the earlier edition was published. Their significance is intimately tied to today's need to transmit bulk power in ever larger blocks and at ever higher voltage, between supply points and load centers in built-up areas. Pipe cable systems are thoroughly treated in a section that covers details of design, oil and gas pressure systems, installation techniques, and operating procedures. Loading practice is well documented.

Impact of air conditioning and other weather-sensitive loads on summer power system peaks has put a premium on ability to load underground systems economically. It is significant that the chapter on cable and underground equipment loading is one of the most exhaustive in the book. Here all papers on the subject of cable loading have been consolidated into a comprehensive presentation that lets the reader make his own calculations from basic equations set up, or estimate cable load capabilities from tables.

Growth of Networks Accelerating

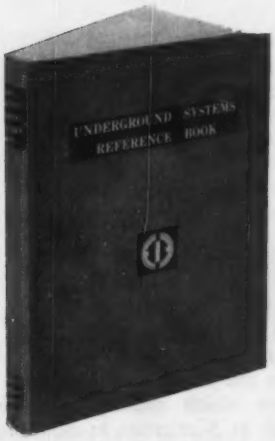
Hardly less significant than the growing revolution in cable loading is the accelerated growth of ac network systems. In 1931 some 52 companies operated 152 networks with a load of 783,000 kva. In 1952 82 utilities operated 414 networks serving a total load of 4½ million kva. Today networks are being extended to commercial areas, small cities and towns, industrial plants, and shopping centers. Secondary voltages have increased in some instances to 265/460 and primary voltages to 69 kv to meet demands imposed by large office buildings.

The impact of these trends is evident in the chapter on underground secondary network systems. Its treatment of basic network design principles, primary and secondary design, and specialized network apparatus is outstanding.

The evaluation and description of modern cable fault location methods are characteristically complete and useful. They point clearly to the conclusion that no

Meet the Editors . . .

Editor-in-Chief James A. Pulsford



The heroic job of directing the editorial activities of the staff of 134 *underground experts who prepared the new reference book fell on the broad and capable shoulders of "Jim" Pulsford. How well he did his job is easily seen in the pages of his book and will become increasingly apparent as its sphere of influence widens with use. But what it cost in time, in planning and in careful methodical attention to detail can't be counted or measured. Certainly no one knows better than Jim Pulsford but it would be unlike him to talk about it.*

He's a soft-spoken man whose competence in technical matters springs from 34 *years in electrical engineering,* 30 *of them in the field of underground. From Harvard Engineering School, he came to Public Service Electric and Gas Co as cadet engineer in* 1923, *rising in* 1940 *to distribution plant engineer for underground and this year to assistant transmission and distribution engineer. He served as underground sponsor for the Transmission and Distribution Committee of the Edison Electric Institute from* 1947 *to* 1950 *and as Chairman from* 1951 *to* 1953 *after which he took on the task of up-dating and revising the old Underground Systems Reference Book, which had gone un-revised since its original publication by the NELA in* 1931.

But even such a man as Pulsford could not have done the four-year job of revision and editing single handed. His able colleague in the venture has been Carlos C. Knox from the engineering staff of Peter F. Loftus Corp who has been Associate Editor-in-Chief. Knox, a graduate of Cornell University, has been associated with the development of modern underground cable systems for 35 *years. He worked on the first* 66-*kv cable installation in the US, the first low-voltage network in Pittsburgh and the first pipe-type cable there. He was associate editor too of the original Underground Systems Reference Book and secretary of the Underground Systems Committee. He served in various capacities for Shanghai Power Co, Byllesby Co and Cleveland Electric Illuminating Co.*

Also sharing the editing job with Pulsford and Knox was E. T. Carmichael of Public Service Electric and Gas Co who served as assistant to the editors.

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one system will locate all faults on all types of locations. But they help the engineer pick an economic one that fits his case.

The tabular classification of common corrosion types by cause, character, tests or observations, and remedial measures is a convenient reference. Sections on instruments and corrosion surveys and on tests are complete roundups of the best in modern practice.

Perhaps a critical review of the book should include the one obvious deficiency; the absence of emphasis on the economics of underground distribution. This is a very controversial subject and, in fairness to the editorial board, thorough treatment might easily require a volume as big as the reference book itself.

The new Underground Systems Reference Book clearly reflects the background education and experience of its staff by the completeness and authenticity of its contents. The 134 authorities who made up its editorial staff were drawn from utilities and manufacturing firms over the entire country. As a result of questionnaires and this wide distribution of authors, no chapter reflects the practices of a single locality. Education and experience of key members are impressive.

Eighteen of the key men have engineering degrees; four from MIT, three from Cornell, two from Lehigh, and one each from Cal Tech, Harvard, Johns Hopkins, Minnesota, Penn State, Texas, Toronto, Virginia, and Washington State.

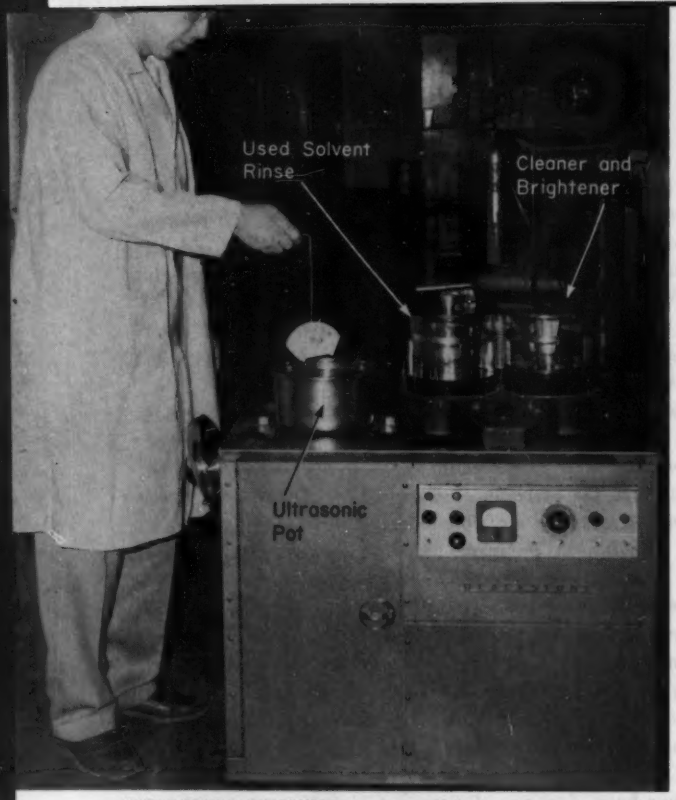
These men have an aggregate of 749 years of experience in engineering work for power utilities or manufacturers of cable primarily for power utilities. Five are fellows of AIEE. All hold positions of engineering responsibility in their companies and are widely known and respected for their engineering ability.

It is not surprising then that the significance of EEI's new Underground Systems Reference Book lies in the fact that it is a reference book written by underground engineers for underground engineers.

Ultrasonics

Satisfactory results have been obtained by the Long Island Lighting Co with this method of cleaning. Cleaning is accomplished in about 3 min and total cost of cleaning is $1.37 per register. Ultrasonics may open the door to a completely automatic cleaning process for meters

J. W. DYE, Meter and Test Superintendent;
A. HOWARD, Associate Engineer, Long Island Lighting Co, Hicksville, N. Y.



ULTRASONIC CLEANING is accomplished in three steps. Final or ultrasonic step requires only approximately 30 sec

Ultrasonic methods of cleaning a cumulative demand register as an assembled unit achieve an expected annual labor saving of $11,000 for the Long Island Lighting Co, and the re-use of certain old registers defer capital expenditures. The registers had been too costly to clean by previous methods.

Ultrasonic cleaning reduces disassembly, cleaning, and reassembly time, major savings accruing from the relatively little disassembly needed. The degree of disassemble depends on the type of register. Greater savings in cleaning costs are probably possible if designs are simplified by meter manufacturers.

Long Island Lighting Co has about 30,000 cumulative demand registers on its system. Under present testing regulations approximately 10,000 of these devices must be tested and maintained each year. Ultrasonic cleaning was first considered for this large program in early 1956.

The principle of the ultrasonic cleaner is that high-frequency (20 KC) waves are generated in a solvent. The waves set up cavitation or "cold boiling" in the solvent by causing sufficient sound pressure to collapse entrapped vapor bubbles. Forces developed in the immediate proximity of such collapsing bubbles are in the order of several hundred atmospheres, but only a fraction of this pressure initiates the cleaning process.

The tremendous forces associated with cavitation literally tear dirt from the object cleaned. Oil present is emulsified by the solvent. This is one of the principle problems in the cleaning cycle, as will be explained later.

Portable Unit Used

The LILCO ultrasonic cleaner consists of a portable unit with a removable solvent pot on top. Electrical impulses are generated in a power unit and fed to transducer coils. The core of these transducers is a group of nickel strips fastened to the bottom of the cleaning pot. The strips are magnetostrictive—that is, they expand and contract as ultrasonic waves pass through them. The mechanical vibration set up by this phenomenon passes through the pot and into the solvent itself, where it sets up pressure waves.

A filter system completes the cleaner. This removes dirty solvent from the pot, passes it through two filters which remove particles as small as 5 microns in dia, and returns the clean solvent to the pot.

Power requirements for the unit can be supplied by a 115-v, 60-cps, single-phase line having a capacity of at least 15 amps.

Ventilating hoods are used whenever volatile or poisonous solvents are used. Hooks, baskets, tongs, rubber gloves, or other protection for the hands are always needed. Hands or fingers must not be immersed in the solvents.

The solvent is probably the most important element of the cleaning system. It must be selected for its sound-wave response characteristics as well as for its ability to dissolve the type of dirt or grease expected. The solvent container is actually a tuned circuit in which the sound waves resonate to pro-

Speed Meter Register Cleaning

duce the maximum cleaning effect.

Although the solvent used by LILCO cleans registers satisfactorily, more research will undoubtly produce a better and perhaps more economical solvent. Since purchasing the ultrasonic cleaner, LILCO engineers have experimented continually with cleaning cycle procedure and different solvents.

Many cleaning procedures were tried to determine a method that would clean registers thoroughly and yet offer some cost saving. After using the ultrasonic cleaner for some time it became evident that contamination of the solvent by the presence of oil on the unclean registers was the major problem in the development of a good cleaning cycle.

Oil contamination caused difficulty in cleaning and calibrating the registers. Calibrations changed when the registers were left to stand for a few days. Contamination made it necessary to replace the solvent after very few registers had been cleaned—an expensive procedure.

During the development period (which is still continuing) different solvents and different pre and post-cleaning procedures have been tried. The final cleaning cycle, based on these test runs, is as follows:

Three-Step Cleaning

All registers are prepared immediately for ultrasonic cleaning when they are removed from the meters if found outside of test limits. Bench checks are not made. Certain parts of the register are removed before cleaning, the parts removed varying with the manufacture. The motor and multiplier plate are removed on all types. The time for disassembly is about 1 to 4 min and varies with the type.

Cleaning takes three steps. The second step has been included only to prolong the life of the solvent in the third or ultrasonic step. So actually it is a two-step operation.

Registers are first spun in a cleaner and brightener solution for 2 min to remove surface dirt, oil, and metal particles. After this, the registers are spun in air for a few revolutions to remove the cleaning solution and loose dirt.

In the second step, registers are spun for 30 sec in a container of used solvent (solvent used earlier in the final or ultrasonic step). This is followed by an air spin to remove by the spin-rinse most of the solution, oil, and surface dirt remaining from the first step.

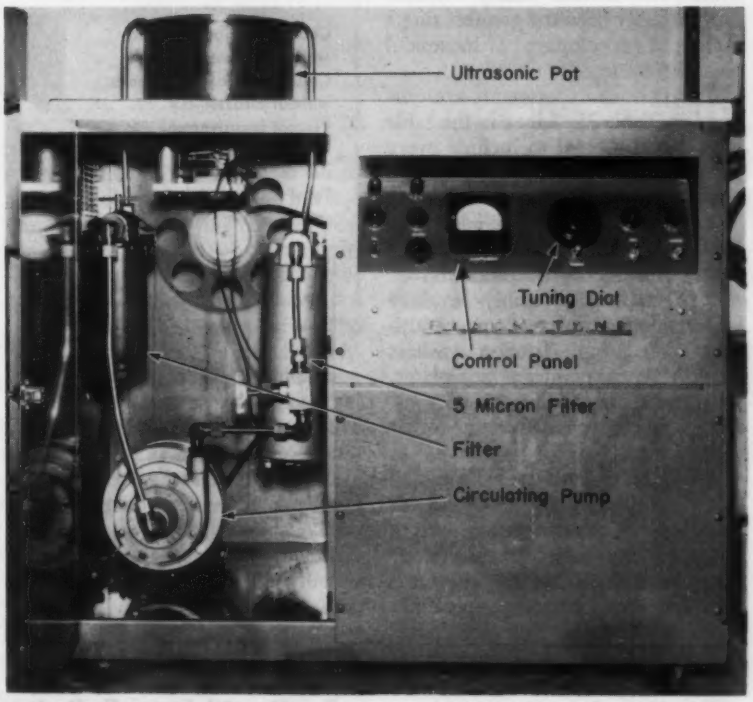
In the final step the register is placed in the ultrasonic pot for about 30 sec. The total operation takes about 3 min. This step removes the last traces of oil and dirt. Bearing holes and other places difficult to reach are adequately cleaned. Complete disassembly would be needed to obtain similar results with former cleaning methods. No further rinse is necessary. Registers dry in a few seconds and can be calibrated immediately. The original friction limits recommended by the manufacture are restored after this operation. Immediate recalibration is possible with assurance that no change in calibration will occur.

Registers ultrasonically cleaned have been considered suitable for return to the field in 95% of the cases tested. The 5% rejected have had mechanical defects which invariably required complete breakdown to correct.

Table I shows the percentages of registers which do not require complete disassembly and the time saved over the previous production method which included a revision of cleaning and handling methods but not ultrasonic cleaning.

Three Minutes to Clean

Cleaning by the ultrasonic method costs about $1.37 per register. Cleaning time is about 3 min, and the total overhaul takes 28 min. The significance of this is apparent



OPERATOR adjusts tuning dial on control panel for maximum visible cavitation in the ultrasonic pot. Maximum cleaning effect occurs when this is achieved

when these figures are compared with results of former years. In 1951, when LILCO's demand register overhaul shop was first established, four registers were overhauled per man per day at a cost of $8.50 per register. Each was disassembled, inspected, cleaned, reassembled, and calibrated by skilled workers. By 1954 experience and greater skill had reduced this cost to $6.82. In 1955, before the ultrasonic method was installed a complete revision of the cleaning and handling reduced the average cost for all registers handled to $2.77. Average cleaning time was cut to 19 min, and the whole job cut to 63 min. Registers were completely disassembled only when their condition indicated damaged or worn parts.

Because there was no prior knowledge in the application of ultrasonics to cleaning registers, considerable experimentation was necessary to establish an adequate procedure. Since the ultrasonic cleaner was purchased in 1956, various rinsing, cleaning, and drying combinations have been tried before the present cycle was selected. Also various types of solvents were used. The solvent finally selected has probably been the greatest single factor in developing a successful cleaning cycle.

The various experiments are outlined in Table II. Lines in the table have been selected to include every possible combination tried in the experiments:

1. Bench checks include both friction checks and accuracy test with self-checking adapters.

2. Partial disassembly evolved into removing only motors, multiplier plates, both friction washers in some types; pointers, face plates, and timing trains in other types. Felt washers are left in another register.

3. Pre-treatments were intended to remove loose oil and dirt to delay solvent contamination.

4., 5., 6. Some cleaning steps were rinses but all steps of the present method are cleaning steps. No rinse is needed.

7. Infra-red drying steps involved only a minute of the operator's time.

8. Reassembly of completely disassembled registers includes checking each part for wear or damage. This step includes recalibration.

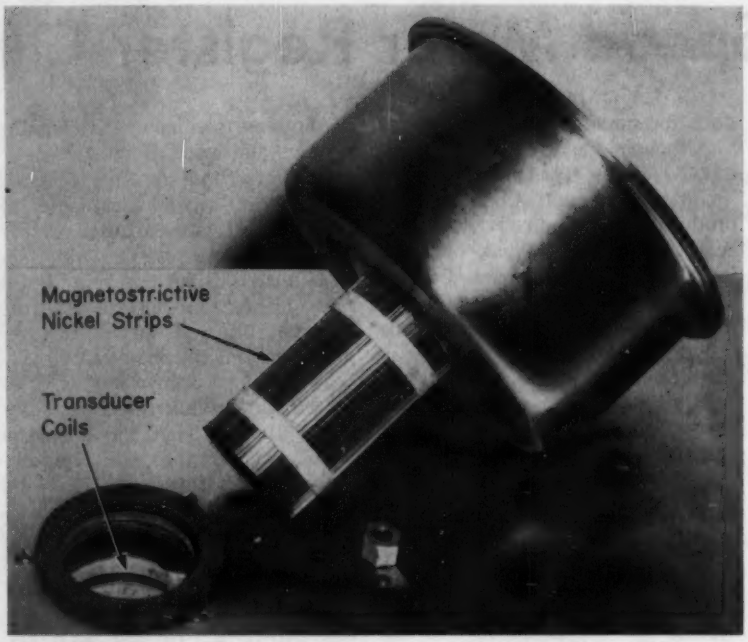
9. Results were as follows:

Original Method—Results were excellent but the operation very costly.

Intermediate Method — Occasionally registers were returned to the repair group to be reworked. While time was nearly halved, it was felt that further improvement was possible and desirable.

Experimental Stages C, D, E—Results were poor. The cleaning solution dirtied quickly and the registers did not dry properly. They were difficult to calibrate, and calibration changed after a few days. The trouble with this first procedure was caused by oil contamination.

A pre-soak stage was added to remove the oil before cleaning. This retarded but did not eliminate the contamination. Adding a second rinse to the cleaning cycle further retarded the oil contamination. But oil was still left on the registers after they dried. Erratic readings, difficulties in calibration,



NICKEL STRIPS fastened to bottom of pot expand and contract as ultrasonic waves pass through them. This causes mechanical vibrations in the pot itself

Table I—Ultrasonic Methods Speeds Cleaning of Cumulative Demand Registers

	Register A	Register B	Register C
Cleaned using ultrasonics without disassembly	78%	93%	96%
Cleaned before ultrasonics without disassembly	58%	60%	30%
Percent improvement	20% *	33%	66%
Total time saved per register	13 Min	46 Min	45 Min
Total maintenance time saving in per register	38%	63%	50%

* Formerly retired.

Table II—Chronological Table of Development Stages—Ultrasonic Cleaning of Demand Registers

Method	A Original Method	B Intermediate Method	C Exp. Stage	D Exp. Stage	E Exp. Stage	F Exp. Stage	G Exp. Stage	H Exp. Stage	I Present
1 Bench Check Required	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
2 Disassembly	Complete		(Partial or Complete Disassembly)				Partial or Complete	Partial	Partial
3 Pre-Treatment	.....	.....	.....	Presoak in KA	Presoak in KA	Vapor Degreaser 15 Sec.	.....	.....	.....
4 Cleaning Step 1	L&R No Fome	L&R No Fome	Ultrasonic KA 2 Min.	(Ultrasonic Machine KA or L&R No Fome 2 Min.)			Ultrasonic L&R No Fome 2 Min.	L&R No Fome 2 Min.	L&R No Fome 2 Min.
5 Cleaning Step 2	L&R Rinse	L&R Rinse	(Dip rinse in KA rinse or L&R rinse)			Vapor Degreaser 15 Sec.	L&R No Fome M-50 2 Min.	Ultrasonic M-50 30 Sec.	L&R No Fome Used M-50 30 Sec.
6 Cleaning Step 3	L&R Rinse	L&R Rinse	.....	.....	Dip Rinse KA Rinse	.....	.....	.....	Ultrasonic M-50 30 Sec.
7 Drying	Hot Air 19 Min.*	Hot Air 19 Min.*	Hot Air 6 Min.*	(Infra-Red Lamps) 1 hour		.....	.....	.....	.....
8 Reassembly (average)	60 Min.	40 Min.	40 Min.	40 Min.	40 Min.	.....	40 Min.	22 Min.	22 Min.
9 Results Total Time	Excellent 120 Min.	Good 63 Min.	(Poor—oil contamination unsatisfactory)			Registers Damaged by Degreaser	Good 49 Min.	Excellent Rapid M-50 Contamination	Excellent 28 Min.

* Total Cleaning Time

and changes in friction readings were still evident.

Experimental Stage F—Registers could safely be placed in the vapor degreaser for only about 5 sec. Longer immersion resulted in damage to cork clutches and other sensitive parts. But immersion for only 5 sec was inadequate.

Different combinations of the degreaser, ultrasonic cleaner, and a commercial cleaning machine failed to solve the problem. At this stage of development it was decided to attack the problem by an intense investigation of solvent characteristics. After a great number of solvents were tried, one was finally discovered that seemed to leave the register oil free and the solvent less subject to contamination through oil emulsification.

This latter point is important because some solvents would clean a few registers satisfactorily but not without contaminating themselves. This involved continual changing of the register solvent and a consequent increase in cleaning cost.

Experimental Stages G, H—The M-50 (trade name solvent is trichlorethane) used in the second stage rinsed away the first solvent and required no rinse itself. As it dries rapidly, the drying stage is eliminated. It was discovered that a higher degree of cleaning in bearing holes and gear teeth was obtained by using the ultrasonic machine last.

Present Method—Differs from Experimental Stage H only in the addition of the middle step. This step increases the life of the ultrasonic solvent from 12 registers to about 30, and when the used solvent is properly filtered, the ultrasonic solvent can be used for up to 50 registers.

In the cleaning cycle in use the cost of solvent per register is $0.44. With earlier solvents the cost was $0.53 per register, and this failed to clean adequately.

Development continues by both LILCO and solvent manufacturers. Although satisfactory results are obtained with the present cleaning cycle, it is felt that further developments will lead to improved techniques.

LILCO is experimenting with this type of cleaning for glass covers, cyclometer registers, jewel bearings, and various instrument parts. Completely automatic cleaning of meters may be a possibility if economic design and latest handling techniques are properly used.

Smaller Current Transformers Match

Consistent matching is achieved when CT's mechanical rms symmetrical rating is 60.3% of power breaker's rms momentary rating

A. CONANGLA, Engineering Manager, 15-Kv Switchboards Section, I-T-E Circuit Breaker Co, Philadelphia, Pa.

Successful application requires that current transformers be capable of withstanding the same peak value of current as the circuit breakers to which they are connected. Consistent matching is achieved when the current transformer's mechanical rating in rms symmetrical amp equals 60.3% of the power circuit breaker's total rms momentary rating, or 70.7% of the low-voltage air breaker's average total rms interrupting rating. Frequently the current transformer can be of even lower rating selected to withstand available short-circuit current. Current transformers applied on this basis will often provide more accurate measurement or a more suitable ratio for metering.

Selecting a current transformer to match a 5-kv, 75-Mva circuit breaker illustrates this approach. Optimum CT turn ratio for this particular circuit is 75/5. But the only transformer in one manufacturer's catalog which provides this ratio and has a mechanical strength exceeding the breaker's 20,000-amp momentary rating has a 10H20 relaying accuracy. To get the desired 2.5H100 accuracy would require accepting an inadequate 150/5 ratio. But when the transformer is matched to 60.3% of the breaker's 20,000-amp momentary rating, a 75/5 transformer of 13,500-amp mechanical strength can be applied for 2.5H100 relaying accuracy.

Transformer Evaluated by ASA Method

Such transformer matching is permissible because the transformer's mechanical strength is rated on a different basis from the momentary rating of a circuit breaker. The mechanical rating of a current transformer, according to ASA C57.13, is stated in rms symmetrical amp. The intent of this method is to permit selecting a transformer directly from the calculated rms symmetrical fault current.

But fault currents are usually asymmetrical. The CT rating allows for this possibility by assuming that fault current may be totally offset and that its dc component does not decay. To justify a mechanical strength rating of I_t amp rms symmetrical, a current transformer must withstand on test the peak value of I_t totally offset as shown in Fig 1. As it is not practical to produce the totally offset current required to test transformer strength, the ASA method requires application of four successive current peaks of twice the rated rms value. Thus the mechanical strength of the transformer in symmetrical rms amp I_t is determined by testing at a peak current of $2\sqrt{2}\,I_t$.

The rated momentary current of a power circuit breaker, according to ASA C37.4, is "the maximum rms total current which the circuit breaker shall be required to carry. The current is the rms value, including dc component, during the maximum cycle as determined from the envelope of the current wave. For determination of current, the method shown in C37.5-1953, or the latest revision, shall be used."

C37.5 in turn describes a simplified method for determining the rms value from measurements of the ac component of a wave and of the displacement of its axis at a chosen instant. The value so determined is the rms of a sine wave having the same amplitude as the measured wave and a non-decaying dc component equal to the actual dc component at the instant considered. This method is an acceptable approximation to the rms calculated for a complete current loop by actual integration of I^2.

In practice a 3-phase fault is applied to the breaker, and the three currents are recorded on an oscillogram. Amplitude of the envelope and wave axis displacement are measured at the largest current peak. The total rms value computed from those measurements is the momentary rating justified by the test, provided the breaker sustained no damage.

Breaker's Safe Peak Current Must Be Determined

In coordinating a current transformer with a breaker, it is desirable to know the peak current that the breaker can safely withstand. European manufacturers provide this in their momentary rating. But ratings based on the American practice of giving the rms momentary rating require calculating the peak value. Exact calculation is not possible because the amplitude of the ac component and/or the instantaneous value of the dc component are not given. But it is safe to assume that the peak was the largest that could yield the stated rms value in a practical test circuit.

The highest first peak occurs in a phase where the fault starts at the instant when the steady-state current would be maximum. The fault current in that phase will be as shown in Fig 2. The value of the first peak and of the total rms amp at the instant of peak depends on the decay of the dc component. This in turn depends on the reactance-resistance ratio of the test circuit. The first peak occurs about 0.5 cycle after the fault is initiated.

Calculated values of instantaneous current, conventional rms current at one-half cycle, and the calculated ratio of these two values are shown on Fig 3.

On a practical test circuit the X/R ratio may be assumed at 10, corresponding to 0.1 pf. Fig 3 shows 1.7 for the corresponding peak-rms ratio. Thus, in the worst possible case:

$I_{\text{peak } pb} = 1.7\ I_{pb}$

where I_{pb} = momentary rating of power circuit breaker, total rms amp,

$I_{\text{peak } pb}$ = max. peak amp breaker can withstand

Equating this breaker capability to the $2\sqrt{2}\ I_t$ determined as the peak-current capability of the current transformer reveals that the CT mechanical rating I_t need not exceed $0.603\ I_{pb}$. In other words, a CT matches a power circuit breaker when its mechanical

Breaker Ratings

strength is 60.3% of the breaker's momentary rating.

Ratings for low-voltage circuit breakers are defined by C37.13 in essentially the same wording as is used for power circuit breakers. The standard does not stipulate the peak current that the breaker is required to withstand to justify a momentary and interrupting rating. But it does specify that the breaker rating is the average of the total rms in three phases at one-half cycle after the fault starts. The largest first peak will be obtained in a circuit where the fault starts with maximum offset, as shown in Fig 2. The peak will occur at one-half cycle (very nearly), and its calculated value is given by the right hand curve of Fig 3 for rms symmetrical = 1.0. The value depends on the X/R ratio of the circuit.

The average total rms of the three phases, for rms symmetrical = 1.0 and total offset in one phase, varies also with X/R ratio of the circuit. A curve giving the calculated value of this average, from the AIEE "Guide for Applying Low-Voltage Air Circuit Breakers," Oct. 1949, is reproduced on the left hand of Fig 3. It is interesting that the calculated average rms for faults with no offset on one phase follows a curve very close to the curve corresponding to full offset in one phase. Although the current in one pole of the breaker may vary considerably from no offset to total offset, the average of the three currents at one-half cycle, and therefore the momentary and interrupting rating justified by the test, will be practically the same value. To be sure that the breaker meets the worst condition of practical applications, the test program should include faults with total offset in one phase.

Curves Convert Interrupting Rating to Peak

The instantaneous value curve (right hand) and the average rms curve (left hand) in Fig 3, permit calculating from the breaker's interrupting rating the maximum peak it may be assumed to withstand provided the X/R ratio of the test circuit is known. C37.14 states that the power factor of the test circuit is normally less than 0.15 lagging, which is equivalent to $X/R = 6.6$ or greater. Furthermore, the 1.25 factor recommended in the "Guide for Applying Low-Voltage Air Circuit Breakers" to obtain the required interrupting capacity from the calculated symmetrical rms 3-phase fault current implies $X/R = 11.72$. It must be assumed that the breaker can withstand the greatest peak in a circuit where $X/R = 11.72$.

The peak current in the totally offset phase is 2.5 times symmetrical rms current for $X/R = 11.72$, according to Fig 3. The average rms for this X/R at one-half cycle (interrupting capacity) is 1.25 times symmetrical rms current. Therefore the peak capability is twice the interrupting rating or:

$I_{\text{peak } lv} = 2\, I_{lv}$

where I_{lv} = interrupting rating of low-voltage breaker, in amp rms

$I_{\text{peak } lv}$ = max. peak amp breaker can withstand

Equating this breaker capability to the $2\sqrt{2}\ I_t$ capability of the CT reveals that the transformer's mechanical rating need not exceed $0.707\ I_{lv}$. Thus a CT matches a low-voltage circuit breaker when its mechanical strength is 70.7% of the breaker's interrupting rating.

In most applications, the breaker rating is greater than the available short-circuit current. And inconsistent installation may not be objectionable as long as the transformer is strong enough to withstand the maximum available short-circuit current. This may permit selecting a weaker but more accurate transformer, or one with a more suitable ratio.

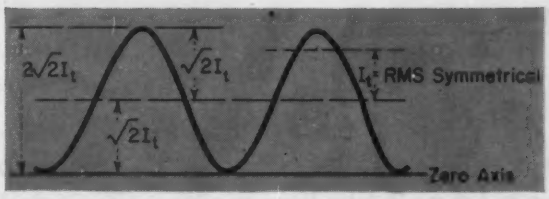


FIG 1—TO JUSTIFY mechanical strength rating of I_t amp rms symmetrical, a current transformer must withstand on test the peak value I_t of a totally offset sine wave

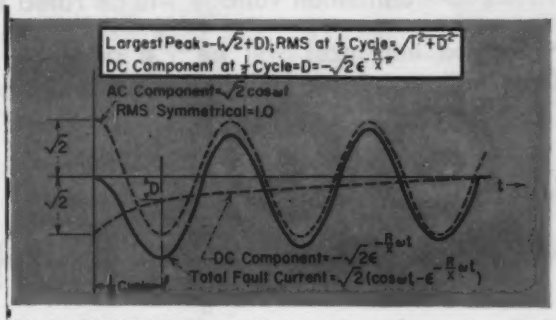


FIG 2—HIGHEST FIRST PEAK occurs in a phase where fault starts at instant when steady-state current would be maximum. Fault current in that phase would be as above

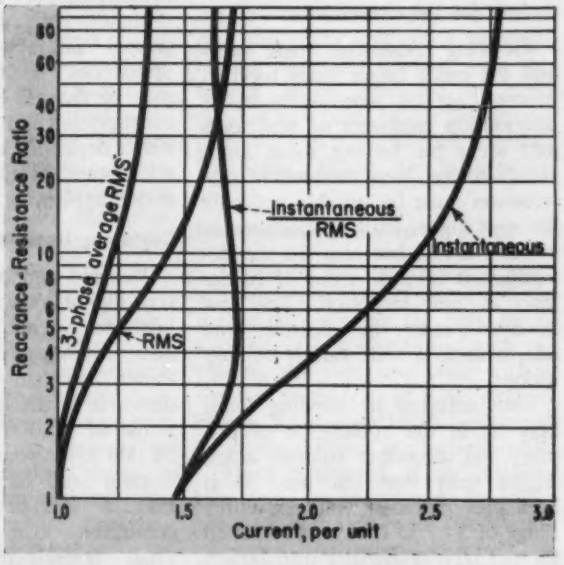


FIG 3—CALCULATED VALUES of the instantaneous and conventional rms current are computed at one-half cycle for a fault with maximum offset and with rms symmetrical of 1.0

- Primary distribution voltages may be 69 and 34.5 kv, with 7.6 or 2.4-kv lines serving as secondaries
- Ground-level transformers at each home to supply 120/240-v utilization voltage will be rated to 15 kva
- Service entrances will be 7.6 or 2.4-kv buried cable from hollow, plastic poles to individual transformers

Take a Bold Look at Distribution:

H. G. HALLY, Engineer in Charge, Transmission & Distribution, Iowa Power & Light Co, Des Moines, Iowa

Growing residential loads today and the much larger loads forecast prompt serious consideration by distribution engineers of new tools and ideas for serving these loads satisfactorily. New methods of distribution must be suitable not only for spot higher-load applications in existing areas, but also for the development of new areas of higher load at their inception. The new methods must be flexible and adaptable to a wide variety of conditions.

One solution to growing loads may lie in the application of primary and secondary voltages much higher than those in use. It is here proposed that voltages in the range of 34.5 to 69 kv will be used for primary residential distribution in the future. Voltages in the range of 4 to 13 kv may be classified as secondary voltages, with installation of 7.6 or 2.4-kv underground services to residential customers. A ground-level transformer at each high-use customer's premise would be an integral part of the service.

Justification for and applicability of this solution may be found in the characteristics of residential loads expected in the near future. National average annual residential usage has been forecast at 8,000 kwhr by 1970, or 2⅔ times the present 3,000-kwhr annual use. A substantial part of the total usage probably will come with a much greater saturation of heavy-duty appliances. Electric space heating may be the principal item of kwhr consumption and may stimulate customer desire for electric water heaters, clothes dryers, ranges, and other major appliances.

Customer Uses 40,000 Kwhr

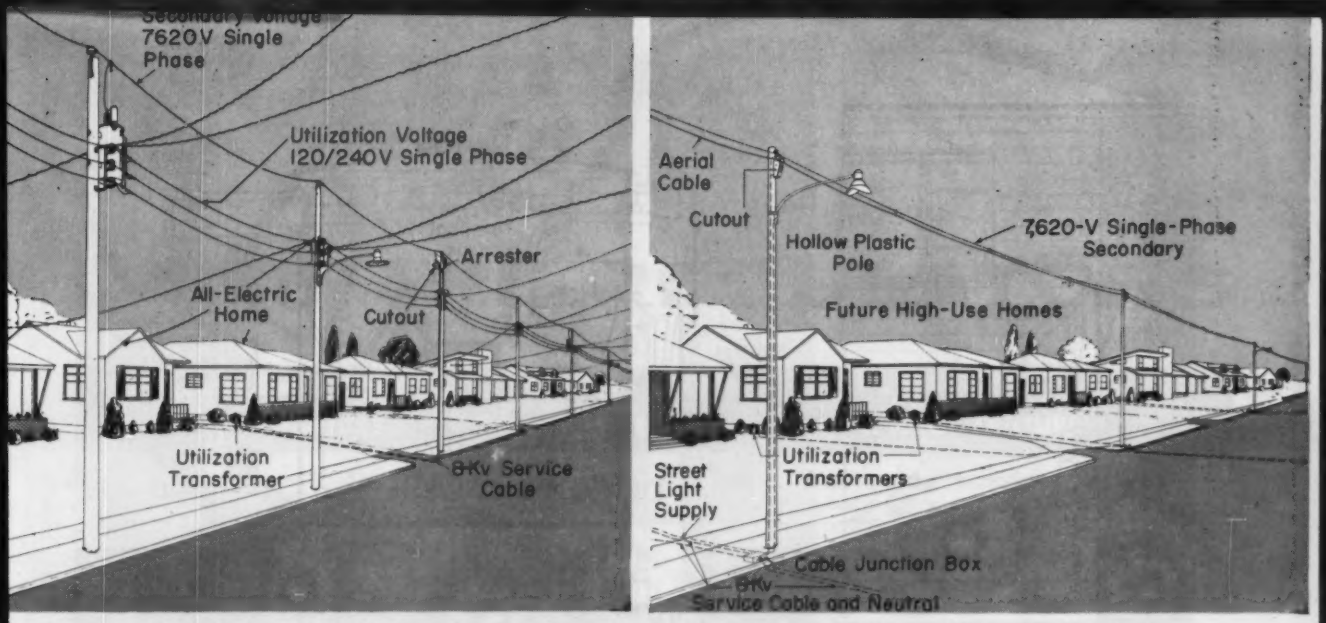
Demand and consumption of future high-use customers may be illustrated by one all-electric home near Des Moines, Iowa. This customer has had consistent winter demands of 18 kw and an annual usage of 40,000 kwhr, of which, 30,000 kwhr went for a resistance heating load of 18 kw. The remainder was used by 26 kw of connected load comprising the usual household appliances, an electric water heater, range, and clothes dryer. This home has no comfort cooling equipment.

Such loads in quantity in the future will bring major distribution system problems. The residential group demand may increase at some higher rate than that for increased kwhr usage. Diversity at the residential service pole, for any practical purpose, may cease to be.

Future all-electric customers of the type described may be expected at first in single units or in small groups scattered throughout the system in both established areas and new developments. The problem therefore will be to provide initially for higher individual demands and at the same time avoid rebuilding transformer installations, secondaries, and services whenever another such demand occurs.

For many years system voltages of 34.5 and 69 kv have occupied an important position as transmission or subtransmission voltages, capable of distributing bulk power to wide areas. The same has been true on a much smaller scale of primary voltages of 4 and 13 kv, and secondary voltages below 600 v. As load density increased, these voltages became relatively less capable of area coverage, and higher voltages were superimposed to deliver larger blocks of power. As growing residential loads will further reduce the relative performance of present system voltages, it appears that new concepts of residential distribution system design will be necessary.

It is proposed that voltages in the range of 34.5 to 69 kv will be relegated to primary distribution use. System facilities at these voltages may be handled in much the same manner as they are at present, with the possible exception that a considerable number of single and 3-phase branch taps may be installed between switching points to serve small substations in suburban areas.



For growing loads in existing homes, and . . . For much higher loads in future homes

It is likely too, that voltages in the general range of 4 to 13 kv be used as secondary voltages, with the installation of 7.6- or 2.4-kv services to residential customers. In existing residential areas, services to customers having the higher kw demands would be underground, single-phase 7.6 or 2.4 kv. A transformer would be installed as an integral part of the service. Existing pole-mounted transformers and secondaries serving other customers would not be disturbed, until the saturation of utilization transformers became great enough to warrant their removal.

In new housing developments, all customer services would be underground, single-phase 7.6 or 2.4 kv, each customer having a separate transformer.

Use Plastic Poles

As an example of what could be done, such installation might use hollow plastic poles and separated aerial cable with the neutral acting as a messenger and shield wire. The cable riser inside the pole could terminate at the top in a bushing-cutout arrangement. The jaw end of the cutout would be installed on the terminal which clamps the phase conductor. A cable junction box, in which cable riser and services are terminated, would be at the base of the pole.

The same junction box also could accommodate the secondary conductors when a complete underground system is ultimately installed. Services to customers would be 8-kv, No. 8, single-conductor cable accompanied by a bare neutral conductor of equivalent size. The system and service neutrals would be solidly grounded. Wood poles and open-wire construction also could be used, the choice of other equipment and system voltage being a matter of local preference.

Transformers would be outside, but adjacent to, the residence, as shown in Fig 1. Transformers would be designed to accommodate a variety of kva ratings of core and coil assemblies in the same tank. Ready access would allow changing the core and coils to suit the individual customer's needs. The customer's service and overhead system in the street would then become a highly permanent installation.

Basic design for such a transformer, using a modified tank of a 15-kva, single-phase 7.62-kv-120/240-v self-protected unit, is shown in Fig 2. The tank has been reduced in height, and the bushings, arrester, tap changer, high-voltage protective link and low-voltage breaker have been removed. Fin-type radiators were added to increase heat transfer.

The 8-kv and 600-v service cables enter the tank through cable seal bushings above the oil level. All internal connections are under oil. The entire unit could be semi-buried, or above ground with the service cables enclosed in rigid conduit to a point below the ground line. With its cover locked in place, this unit would be completely sealed.

Transformer Rated to 15 Kva

Changing the kva rating of such a transformer would be a simple matter of removing the tank cover and internal connections, and replacing the core and coils with a similar assembly of the desired rating. Ratings up to 15 kva would be accommodated in this basic unit.

Many variations of the installation could be considered. Probably the most desirable, would be a completely buried unit. However, a buried transformer has problems of heat transfer, moisture, and corrosion, which could preclude the use of standard transformers and necessitate further transformer development.

Voltages below 600 v, and specifically 120/240 v for residential use, will be classified as customer utilization voltages and will be used as in present customer practice. Present customer metering practices generally would not be disturbed. However, each customer having a separate transformer also

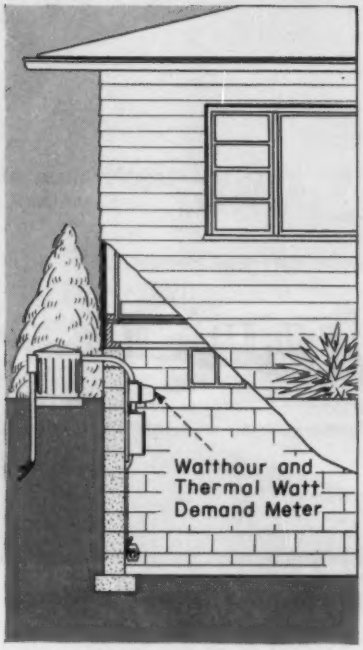


FIG 1—GROUND LEVEL transformer could be supplied by 7.6-kv or 2.4-kv 1/c cable and bare neutral

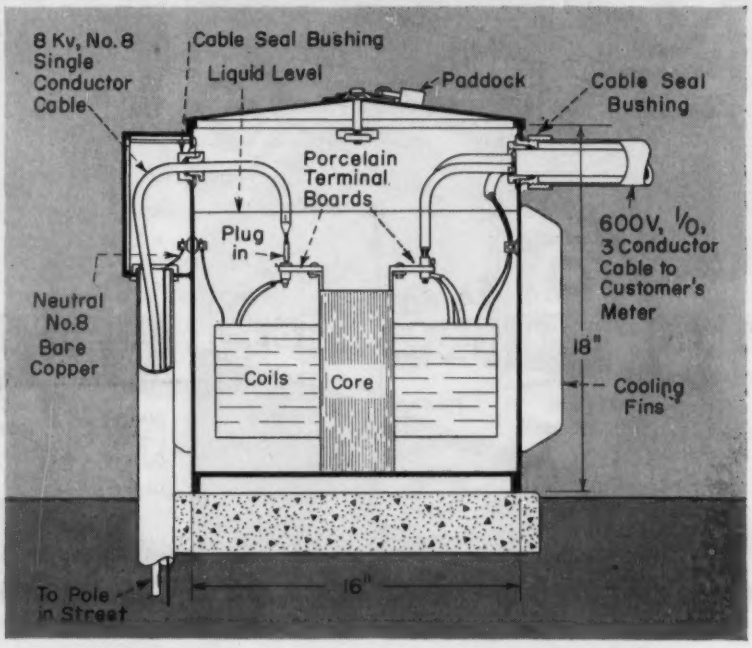


FIG 2—MODIFIED DESIGN of a 15-kva, single-phase, 7.62-kv-120/240-v, self-protected transformer would serve one customer. Rating could be changed up to 15 kva through use of interchangeable core and coil assemblies

would have a combination watthour and thermal-watt demand meter. This would permit the reporting of transformer loading each time the meter is read. Ultimately such meters might become a part of the utilization transformer.

Street lights in newly developed areas would be served individually by a small underground cable tapped from the nearest utilization transformer. In existing areas the present practice would prevail until the saturation of transformers became enough to warrant a change.

Advantages Listed

The proposed scheme has several advantages:

1. Gradual development of the existing system and wider application of higher voltages will provide ample capacity for any foreseeable customer load.

2. The scheme will result in a highly permanent overhead distribution system having great flexibility.

3. The residential overhead system will improve operating conditions, safety, and service continuity. Tree-trimming and outages caused by birds, squirrels, and lightning would be greatly reduced. Servicing and equipment would require less pole work and heavy equipment, thereby reducing some problems encountered in rear-property construction.

4. Improved appearance of the system would result in good reaction from the residential customer.

5. Close control of installed transformer capacity would be another advantage. Transformer capacity could be changed quickly, and exact and up-to-date information on transformer loads would be available readily.

6. Secondary circuit losses and voltage drops would become relatively negligible.

The proposed distribution also has a few disadvantages:

1. High initial cost. Capitalization in transformer capacity would be higher than for conventional systems.

2. So far as transformer loads are concerned, there would be no diversity among customers, and total transformer losses would be greater.

3. Local restrictions on the installation of high-voltage cable and equipment on customer premises might be a problem in some areas.

To evaluate the importance of these disadvantages, further consideration of the economic aspects of the proposed scheme is necessary. The apparent disadvantage of the initial high cost of one or more components of the system may be more than offset by a substantial reduction in operating and maintenance costs. Increased consumption and revenue and changes in present practices for serving the added loads must be considered.

Losses Balance Out

Diversity is an important factor only when it can be used to advantage. Although future residential loads may provide some diversity at the service pole, it may prove not to be dependable in the application of distribution transformers. By comparison with present practices, additional transformer losses would be compensated for by lower losses on the higher-voltage secondary system and services.

NOW: From General Electric's
Regulator Engineers:
A Chart Designed To Help You . . .

COMPARE REGULATORS

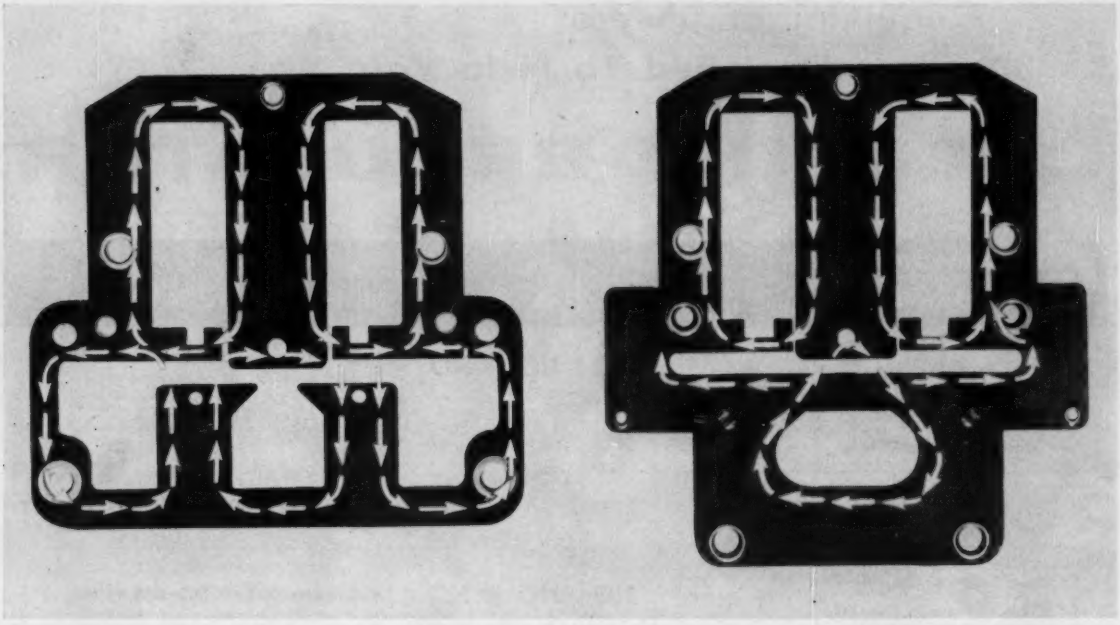
Single-phase Step Voltage REGULATOR FEATURE	G-E	A	B	C	MEANING OF FEATURE
Electrostatic Shielding	YES	NO	NO	NO	Helps prevent build-up of arc-causing carbon deposits at critical points.
Controlled Switch Speed	YES	NO	YES	YES	Gives longer contact life. Means less maintenance.
32 ⅛% Step Regulation	YES	YES	YES	NO	Provides closest voltage control. Less contact wear.
Locking Screws On All Control Knobs	YES	NO	NO	NO	Makes sure that settings stay set.
Panel-mounted Reverse-Reactance Switch	YES	YES	NO	YES	Simplifies parallel or delta-connected applications.
Plug Connections On All Major Control Components	YES	NO	NO	NO	Allows easier, quicker maintenance of control.
Complete Range of Ratings	YES	YES	NO	YES	Facilitates your system planning.
One-piece Cover Bands	YES	NO	NO	NO	Simplifies maintenance. Pleasing appearance.
Aluminum/Copper Terminals	YES	NO	NO	NO	Offers flexibility; either type of conductor can be connected.
Lightning Arrester For Control Circuit	YES	YES	YES	NO	Provides additional protection to vital regulator controls.
Internal Thyrite* By-Pass Resistor	YES	NO	NO	NO	Affords maximum protection with no chance of external damage.
Steel Control Panel	YES	NO	YES	NO	Provides rigidity. Panel will not warp or break.

FOR MORE INFORMATION on the benefits your system can get with General Electric feeder voltage regulators, contact your G-E Sales Representative or write Section 423-19, General Electric Co., Schenectady 5, N. Y.

*Registered Trademark of General Electric Company for Resistance Material.

Progress Is Our Most Important Product

GENERAL ELECTRIC



FLUX PATTERN in stator of new meter eliminates intermingling voltage and current fluxes. In old design (left) single core accommodated current and voltage fluxes. In newer design (right) each has its separate electromagnet

TODAY'S DESIGN TREND

New Meter Has Two-Electromagnet Stator

Revolutionary stator design gives a new 30-amp, 240-v, 3-wire, single-phase watthour meter the light-load accuracy of a 15-amp meter. This meter has an "on-line" accuracy up to 200 amp and an overload capacity of 667%.

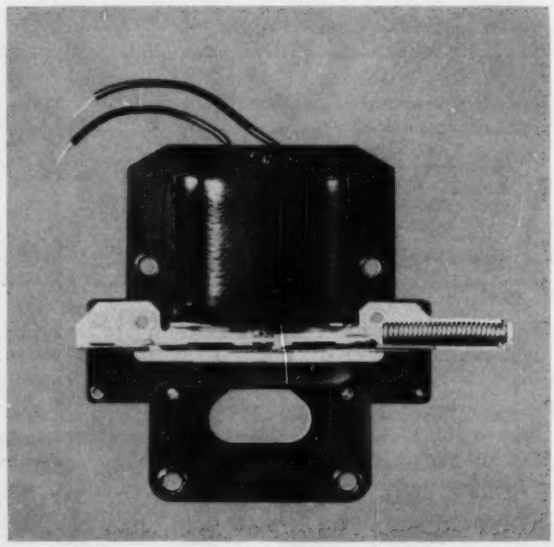
In the new stator, the conventional combined voltage and current electromagnet has been replaced by a pair of magnetically isolated electromagnets, one for voltage and one for current. This magnetic separation of the magnet circuits has obviated the compromises formerly necessary in core design, material selection, and current-coil configuration.

The new construction, according to General Electric Co engineers, minimizes potential losses, torque reductions, coil-balance errors at heavy loads, and a low power factor.

The voltage electromagnet has the usual single pole on which the voltage winding is arranged, and the current electromagnet has the usual pair of current poles, but here ceases the similarity with older models. Instead of being split between two current poles, the current windings are formed into a pair of partially open turns around that part of the electromagnet bridging the two poles. Each coil carries the full load current of its circuit.

Advantages claimed for this coil design are many. As current division is eliminated, coil balance is improved and manufacturing problems are considerably reduced. Obviously the coils require much less copper, about a third as much, taking scrap into account. The

(*Continued on page* 68)



REVOLUTIONARY STATOR is key to meter's performance. Design avoids the many problems of the "split" core design

NEW S-1 SOCKET

Let's Look at Metering This Way...

BEHIND A QUALITY METER SHOULD BE PROTECTION BY A QUALITY SOCKET. THAT'S WHY GENERAL ELECTRIC DESIGNED THE NEW, IMPROVED S-1 SOCKET OFFERING YOU SEVEN IMPORTANT BENEFITS TO HELP METER PERFORMANCE.

The best possible protection is needed for your important metering investment. That's what you look for in a watthour meter socket. Now, the new, improved General Electric S-1 Square Meter Socket has these big benefits which help give top meter performance:

TRUE VERSATILITY. New S-1 comes with one, two, or no hubs, 1¼ or 1½ inches. Mount vertically or horizontally by simply interchanging terminals 90 degrees. Fifth and sixth terminals are added in seconds with only a screwdriver.

PERFECT KNOCKOUTS. Pre-scoring on both sides provides positive knockout every time. One-way knockouts are located on all sides not having hubs.

EASY WIRING. External hubs, large inside working space and lay-in type terminals, requiring only 45 degree wire bend—all make wiring easier, quicker.

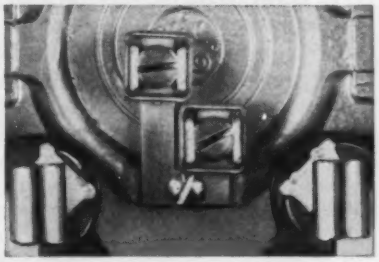
POSITIVE GROUND. You have choice of new lay-in bus-type or serrated strap terminals. Both give positive ground, even with different wire sizes. Bus-type terminal assembly is easily rotated 180 degrees for use of back breakout.

EASY ACCESS. Unique weather-tight snap-lock cover can be removed and replaced in seconds without tools.

100-AMP CAPACITY for growing loads.

HIGH CORROSION RESISTANCE for better all-weather meter protection.

For complete details on the S-1 Socket contact your nearby G-E Apparatus Sales Office or Authorized Distributor . . . or write for bulletin GEA-6563 to General Electric Co., Section 625-5, Schenectady 5, N. Y.



The new S-1 bus-type grounding terminal

GENERAL ELECTRIC

Meter Stator Novel

(*Continued from page* 66)

coils' new location and configuration allow them to be isolated mechanically from the laminations, so that they are free to move from socket forces without affecting calibration.

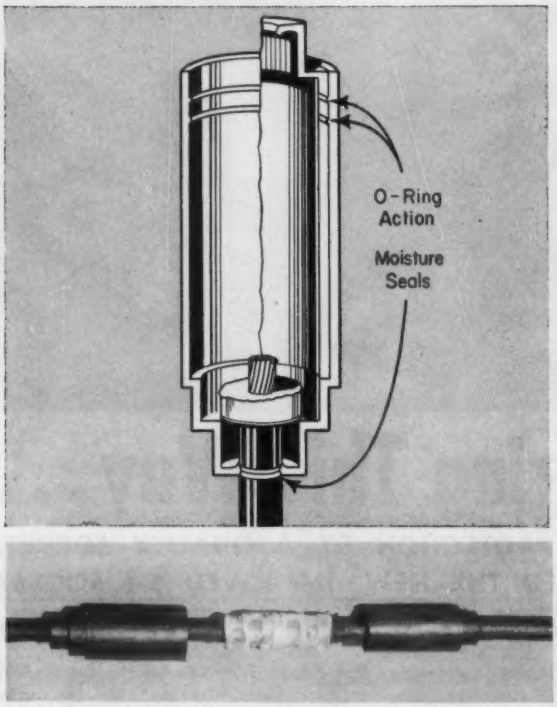
The simple coils are threaded through the current lamination "window" instead of being dropped over the poles. Thus the spacing between the current pole tips can be determined for optimum efficiency rather than for mechanical clearance.

The current coils are insulated by slip-on butyl tubing.

The light-load plate functions magnetically to accomplish the required flux distribution. This method takes the place of the induced-current loop formerly used as a light load adjustment.

DISTRIBUTION—Construction

Plastic Cover Fits Many Service Joints



Two parts slip over connection, interlock...

Give neat appearance to installation

L. C. BARRY, Design Engineer-Distribution, Southwestern Gas & Electric Co, Shreveport, La.

For safe and moisture-free copper-to-aluminum connections at the house, Southwestern Gas & Electric Co uses a one or two-piece molded plastic cover.

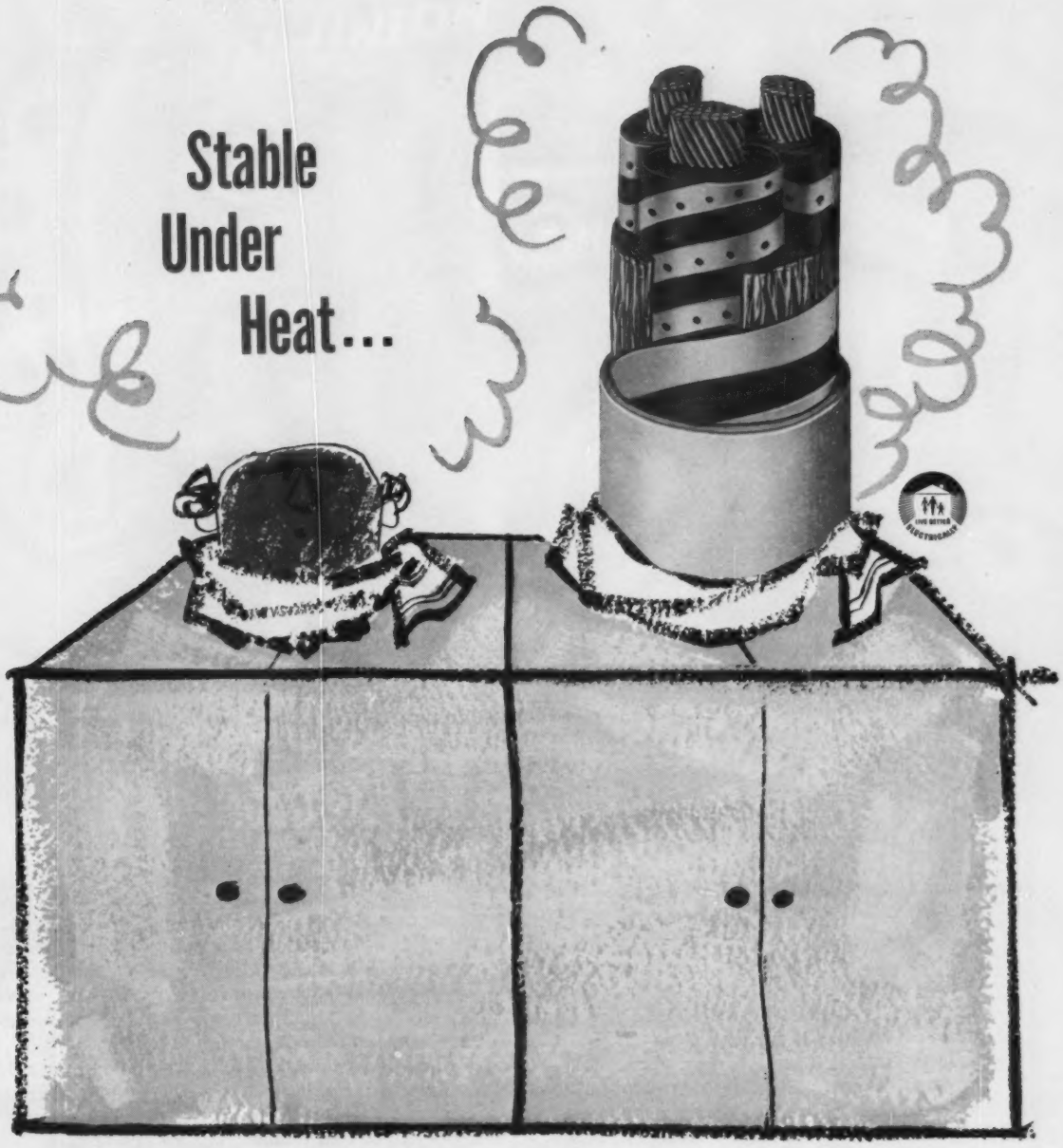
This cover is easily installed and, although made in only one size, is applicable to wire sizes No. 8 through No. 2. Similar in appearance to types used on low-voltage conductors, this cover is of a grade of polyethylene recommended by several chemical companies.

The polyethylene absorbs the inhibitor grease without any reduction of its dielectrical strength or aging characteristics.

The "O" ring effect of its halves gives the cover a vapor-type seal which, tests indicate, no moisture can penetrate. The seal is effected where the wire enters the ring portal. In the design stages, possible "breathing" of the cover was discussed. The cover breathes under temperature changes, but the manufacturer maintains that, due to the cover's elasticity, a slight ballooning offsets most or all of the breathing action through the seals.

(*More How To on page* 70)

Stable Under Heat...



the Tellurium Lead Alloy Sheath on Roebling Paper Power Cable

Sheath temperatures during wiping operations are in the range of 400°F, emphasizing the importance of heat stability. And you'll find that Roebling Tellurium Lead Alloy Cable Sheath retains its excellent creep resistance and bending fatigue resistance even after being subjected to this high temperature.

This is just one of the *extra-life* qualities built into Roebling Paper Power Cable with Tellurium Lead Alloy Sheath. Learn more about this exceptionally serviceable cable that offers so many savings. Write today for free, new, illustrated booklet that tells the whole story! Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

JUMPER of No. 8 stranded flexible copper is covered by corona shield as shown in background and closeup at right

CORONA SHIELD installed over bus connection has smooth surface which inhibits radio and television interference

Corona Shields Prevent RI on 138-Kv Bus

A. A. MILUSICH, Senior Engineer, Consolidated Edison Co of New York, New York, N. Y.

Corona shields for bus connections have been designed by Consolidated Edison Co of New York for installation at 138-kv switchyards in congested residential areas. The shields prevent radio and television interference associated with corona discharge.

As corona concentrates at a sharp point, such as a broken strand of a stranded flexible connector, the shields were designed for all bus connections and for the ends of conductors which do not terminate in connectors or fittings. The outer surface is smooth, and the edges have a radius of at least an inch. A shield is split, and as it is free riding on the conductor to allow for expansion and contraction of the bus, a No. 8 stranded copper jumper connects the inner surface of the shield and the bus clamp.

Effectiveness of the shields was proved on a 138/-27-kv substation installation, where radio interference tests were made with the shields installed on and then removed from an outdoor 138-kv bus section.

SUBSTATIONS—Construction

Steel Crate Protects Bushings

A. W. SHELHORSE, Supervisor, General Repair Shop, Georgia Power Co, Atlanta, Ga.

Sturdy steel crates permit efficient, safe handling and shipment of 110-kv equipment bushings for Georgia Power Co. The bushings are held in a vertical position, which facilitates placing them in and removing them from the crates. Moreover, because the bushings are supported on their flanges, there is less chance of damage from shocks during handling and hauling.

The 4 x 5 x 6-ft crates were fabricated from ¼-in. iron plate and 4-in. channel iron. Six 15½-in. holes spaced on 2-ft centers were cut in the top plate to allow the lower end of bushings to pass through.

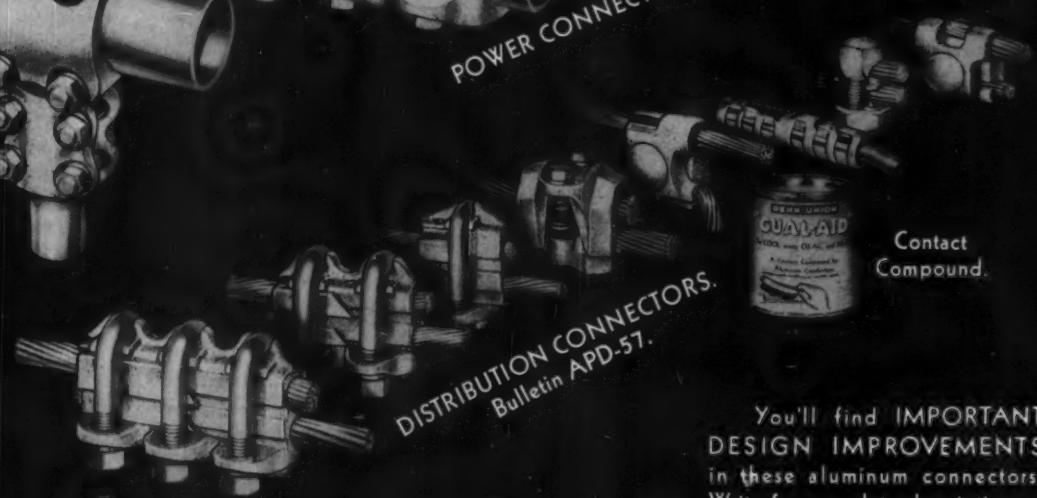
Two small holes, 180 deg apart, were drilled beside the large holes to permit each bushing to be bolted in place securely. Four steel rod hooks were welded to corners of the crate to facilitate loading and unloading by an overhead crane. When a crane is not available, the crate can be moved by placing pipe rollers under the skid runners.

PENN-UNION ALUMINUM

Conductor Fittings

WELD FITTINGS for Tubular Aluminum Bus. Bulletin AW-57.

POWER CONNECTORS. Bulletin APD-57.



Contact Compound.

DISTRIBUTION CONNECTORS. Bulletin APD-57.

You'll find IMPORTANT DESIGN IMPROVEMENTS in these aluminum connectors. Write for complete description— and address of nearest agent— to

PENN-UNION ELECTRIC CORP.
Erie, Pa.

Mid-Central Utilities Beat LBE Drums

Electric utilities in the mid-central states are heavily booming the "Live Better . . . Electrically" message throughout their service areas. At least eight companies in the region have aggressive programs in which LBE plays a big part.

West Penn Power Co carries on one of the most extensive of such programs. West Penn publishes six magazines for specialized audiences. Biggest of WP's books in "Homemaking Today," which goes to some 327,000 residential customers four times a year. Other books go to dealers, distributors, farmers, builders and contractors.

Cleveland Electric Illuminating Co is also fighting the good fight. CEI-sponsored TV programs carry Live Better Electrically spots and commercials. A recent one-month cooperative radio-TV advertising program, on air conditioning carried 249 TV spots and 267 on radio. The power company has also spearheaded some 10 Live Better Electrically newspaper supplements.

Detroit Edison Co is now reaping the harvest of a visitation program with 137 area newspapers (excluding Detroit). The utility agreed to a cooperative advertising water-heater program, in which it paid for half the lines, dealers and distributors the other half. LBE symbols were sent to all papers and included in utility and tie-in ads. Detroit Ed reported good newspaper cooperation and terriffic ad lineage.

Dayton Power & Light Co reports it has integrated Live Better Electrically into every phase of its residential market development programs. Here's a sampling to date:

- Used on radio, TV programs.
- Held six LBE major appliance promotions.
- Ran 30 LBE meetings for children in its modern living center.
- Had more than 10,000 dealer calls in which LBE was an important part of the sales message.

Cincinnati Gas & Electric Co has made some of the biggest news of the year with its "House in the Clouds" promotion at the Cincinnati Electrical Exposition. This all-electric home drew huge crowds, publicity and sales. CG&E has not forgotten its trade allies. TV kinescopes of the 1957 Live Better Electrically plans were the highlights of a series of special dinner meetings for all trade allies.

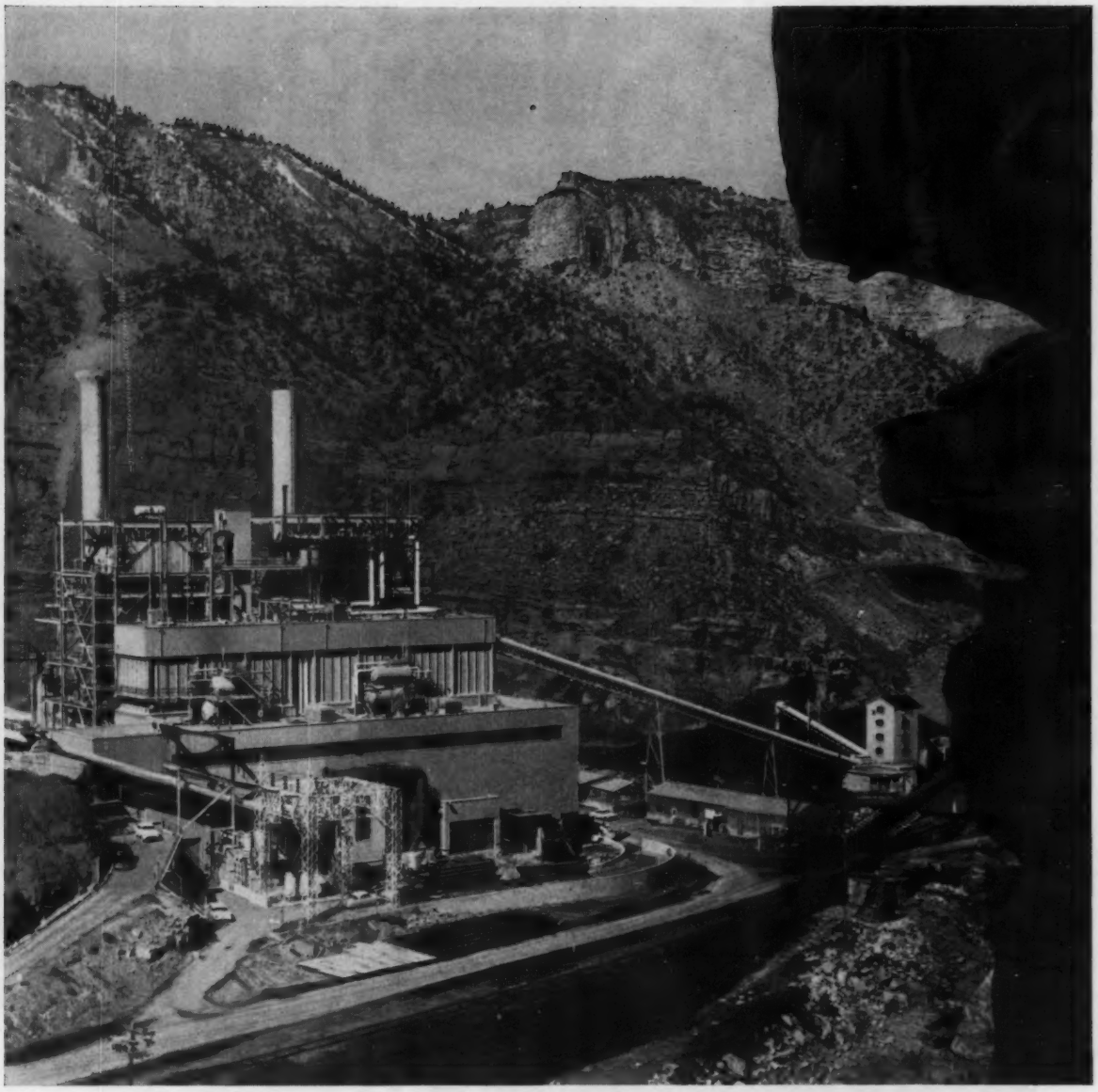
Indiana & Michigan Electric Co stresses the fair-and-home-show technique. Live Better Electrically has been featured at 12 fairs and four home shows in its area this year. Best example was the Fort Wayne Home Show, at which I&M managed to collect under the LBE banner some 44 booths occupied by appliance and equipment distributors and dealers. This drew about 40,000 people.

Ohio Power Co is spreading the Live Better Electrically message with direct mail, including 30,000 consumer booklets, and more than that number of promotional folders. It has also provided several hundred lighted signs for its dealers. OPCO was one of the first companies to identify all its vehicles with LBE decals.

Columbus & Southern Ohio Electric Co has been running an extensive campaign in 33 papers. Its electric buck "Electric-Buck" promotion (EW, Oct. 29, 1956, p 122) has been very successful in boosting dealer LBE cooperation.

LBE DISPLAYS at Fort Wayne Home Show featured some 150 appliance exhibits that drew 40,000 people. Activity like this is typical of mid-central area

(*More Selling on page* 76)



100,000 NEW KW'S FOR UTAH

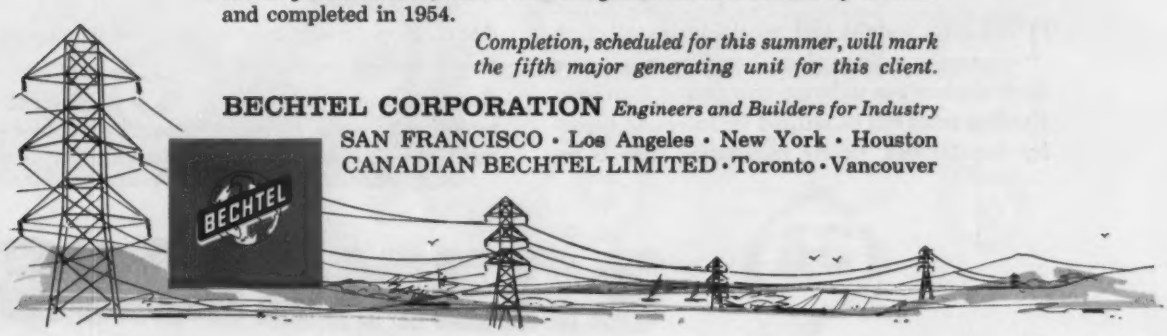
A second unit, generating 100,000 kilowatts, is now being added to Utah Light and Power Company's Carbon Steam Plant, near Castle Gate, in Utah's coal country. It will more than double the present capacity of the power station, which was designed and constructed by Bechtel and completed in 1954.

Completion, scheduled for this summer, will mark the fifth major generating unit for this client.

BECHTEL CORPORATION *Engineers and Builders for Industry*

SAN FRANCISCO • Los Angeles • New York • Houston

CANADIAN BECHTEL LIMITED • Toronto • Vancouver



New 3-phase

COMPACT *Lightweight* STRONG

Greater Capacity on Existing Poles

THE size, weight and resulting installation economies a three-phase transformer has over three single-phase units are now greater than ever. Existing poles can be utilized for increased capacity transformers. Costly installation time is reduced. Transformers may be mounted directly to pole. Handling convenience is improved all around.

Get the complete story. See your A-C representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-

Curvacore Transformer

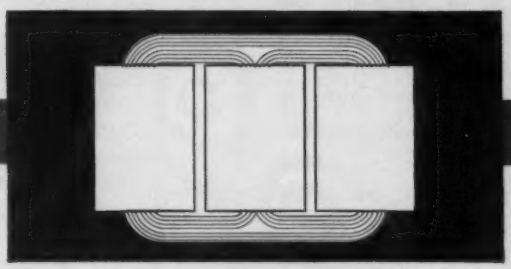
Average 13" Height Reduction

Average 25% Weight Reduction

HEIGHT and WEIGHT
Wound Core 3-phase Transformers
HIGH VOLTAGE — 12 kv through 14.4 kv delta
LOW VOLTAGE — 208Y/120 or 240 delta

KVA	OVERALL HEIGHT		WEIGHT	
	NEW	OLD	NEW	OLD
15	41½	50	610	665
30	44½	62	850	1120
45	51½	63	1115	1300
75	53½	68	1455	1920
112½	59½	70	1930	2565
150	65½	78	2285	3460

Here's Why!



Wound Core Design Makes the Difference

Curvacore design, permitting the maximum use of preferred oriented steel, results in a compact core with low losses and low exciting current. Transformer height and weight are reduced considerably.

Curvacore is an Allis-Chalmers trademark.

CHALMERS

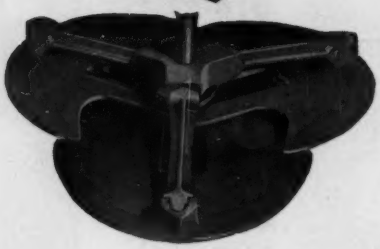
A-C ALLIS CHALMERS

A-5382

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life



● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE EVERSTICK FEATURE
Exclusive Everstick nut housing Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO
FAIRFIELD, IOWA

KG&E Goes After Electric Heat Business

Sales campaign kicked off July 1st reflects changing utility attitude. Commercial, industrial customers not overlooked

Kansas Gas & Electric Co, armed with its second electric heat rate reduction in less than a year, is really going after the electric heating business.

But the reduction (EW, May 27, 1957, p 100) is only the spearhead for the drive. Other weapons in the KG&E arsenal include: A 64-man "army," now on the road holding trade-ally and dealer meetings; a comprehensive advertising schedule on radio, TV, and in the newspapers; and programs to encourge support from trade allies, manufacturers and dealers.

Another feature that makes the Kansas utility's electric heat story different from others: It is not overlooking commercial, industrial, and school customers. In fact, there are really three separate but related campaigns. The residential, known as "Duck Soup!", was kicked off July 1st, and will run through Sept. 14. The commercial and industiral, known respectively as "Foot Warmer" and "Winter Warm-Up," got off the ground on July 1st. They will run through September 27th.

Residential rate has gone from 1½¢ per kwhr to 1¼¢ per kwhr for all use above 1,000 kwhr per month. Commercial and industrial customers and schools get a flat 1¼¢, with no demand charge. KG&E believes it is the first utility to ever establish a special electric heating rate for commercial and industrial establishments. All rates are effective during heating season, Nov. 1st through May 31st.

It is too early yet to talk about results in the KG&E campaign, but early indications are that the company *is getting the business*. The important thing is the utility's changing attitude toward electric heat, which is typical of many others who are having or expect to have summer peaks.

This attitude is reflected in a quote from the "Duck Soup!" campaign outline distributed to KG&E salesmen: "A CHALLENGE—Please set secondary matters aside during this (campaign) period. Electric heating is now a MUST in this company. There is now a heavy responsibility on you, but the rewards are also worthwhile. We appreciate that heating is not yet an accepted customer service. That is why good salesmanship is required. We realize, too, that dealer assistance is not everything to be desired. But, we cannot hide behind excuses. These are the very reasons why there must be no lack of effort on our part."

H & C BRIEFS

Westinghouse Boosts Plant Size

More than 87,000 sq ft will be added to Westinghouse's air conditioning plant in Staunton, Va. This will increase by about one-third the size of the present plant which manufactures a line of packaged air conditioners and heat pumps.

A.C. Costs Evaluated

Equipping a house with central air conditioning costs on the average between $0.67 to $1.10 per sq ft of floor, according to a survey conducted by Frigidaire division of General Motors Corp. Monthly operating expenditures are approximately 1¢ per sq ft.

IEEL Plans Heat Campaign

Plans for an electric heat promotion campaign in the Spokane area have been mapped by Inland Empire Electrical League. Making use of all advertising media, the dealers will start the drive in late summer.

(*More Selling on page* 80)

Wire Sculpture by Henry Szafarz

It's Another World . . .

one in which the forces of nature are extremely rough on man-made things. Thus, the simple fact that Simplex supplies more submarine cable than all other manufacturers combined speaks volumes as to product quality. Simplex Submarine Cables are specifically engineered for reliable underwater communication and power transmission. Their many varieties of outer coverings, wire armor, heavy jackets of Neoprene and other materials, guard against underwater hazards and assure long, dependable service.

SIMPLEX WIRE & CABLE CO.,
79 Sidney Street,
Cambridge 39, Mass.

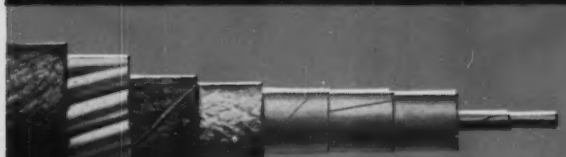


Photo of Transoceanic Telephone Cable, Cut Back to Show Construction

LIVE BETTER ELECTRICALLY

Simplex

Save $2920*

New APT high-voltage potential transformer . . .

greater metering accuracy, 50% more thermal capacity than other low-cost designs

The new Westinghouse Type APT potential transformer is designed for low-cost, positive protection and highly accurate metering. Its single-core-and-coil, single-bushing design holds the edge over both the conventional type and other low-cost designs.

Greater metering accuracy—This new transformer, 92-161 kv meets ASA 0.3 accuracy standards on burdens up to 500 volt-amperes; and, as shown in the graphs below, at 200 volt-amperes burden both its ratio correction factor and its phase angle deviation are only half as much as for other low-cost designs. This means more accurate metering under all conditions.

Higher thermal rating—The Type APT transformer at 115 kv, for instance, has a minimum thermal rating of 6000 volt-amperes.

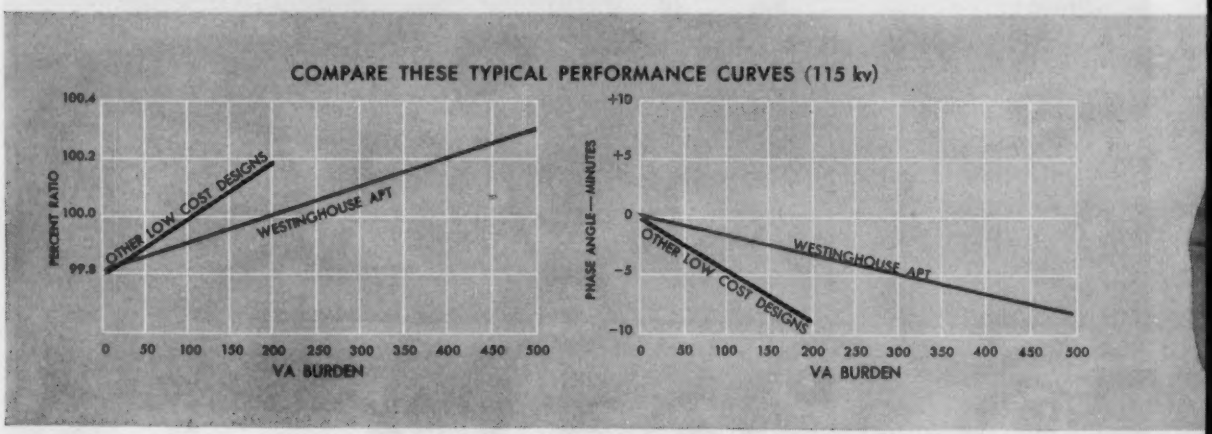
ASA Group 3 insulation—Designed for line-to-neutral operation, the APT utilizes Hipersil® cores fluxed for line-to-line voltage under emergency operating conditions.

Reduced size and weight—Solid insulation and exclusive Hipersil cores combine maximum performance characteristics with minimum size and weight.

For the full story of the performance of the Type APT transformer, call your Westinghouse representative . . . or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

*On a 138 kv APT potential transformer J-70818

YOU CAN BE SURE...IF IT'S Westinghouse



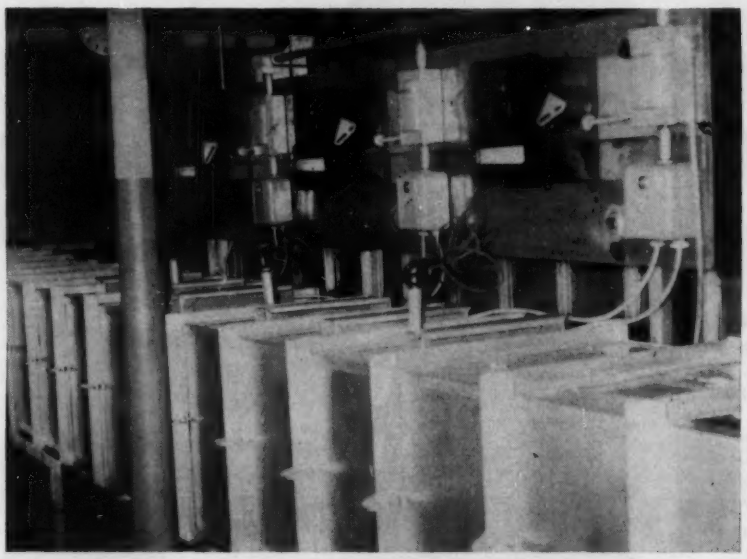
Lower percent ratio error and smaller phase angle deviation of new Westinghouse APT potential transformer contribute to substantially improved metering accuracy.

45% savings

New Type APT potential transformer, available in voltage classes from 92 through 138 kv, meets all ASA standards for high-voltage metering and relaying applications, and offers the following savings:

ESTIMATED NET PRICE COMPARISON

Insulation Class	BIL kv	Conventional Design	Westinghouse Type APT
92 kv	450	$4080	$2230
115	550	4930	2690
138	650	6460	3540
161	750	8110	4460



High Temperature Conveyor Oven . . .

Speeds Capacitor Production

R. B. RUSSELL, Industrial Sales Engineer, Connecticut Light & Power Co, Willimantic, Conn.

Efficient, high quality production and flexibility to meet sudden design changes are two of the big advantages of a high temperature conveyor oven used in the manufacture of ceramic capacitors at the Electromotive Manufacturing Co, in Willimantic, Conn. The oven is used to fuse a conducting glaze of silver onto a ceramic base.

The oven is approximately 25-ft long, with a conveyor belt running through it. The six heating elements are controlled in pairs, forming three zones. Separate controls for each zone hold the temperature at 900 F in the first section and 1450 F in the second and third. Oven and heating elements are designed by Electromotive. Each heating element is an 8x10-inch rectangular ceramic tube, about 14 inches long, with a spiral groove in the outside surface. Resistance wire is coiled and then wound into the grooves. The tubes are placed in the oven end-to-end, with the conveyor passing down the center along the axis.

Load of each heating element is about 2.4 kw, making a total of 14.4 kw for this design. Insulated sectional units forming the oven are placed around the heating elements and extended at each end to form an oven of the correct length.

A number of other similar ovens are used for the fusing, drying, and setting operations. Manufacturing a variety of paper, mica, and ceramic capacitors for the radio and television industry, Electromotive has numerous conveyor ovens. They include both low and high temperature models and range from a few feet to over one hundred feet in length.

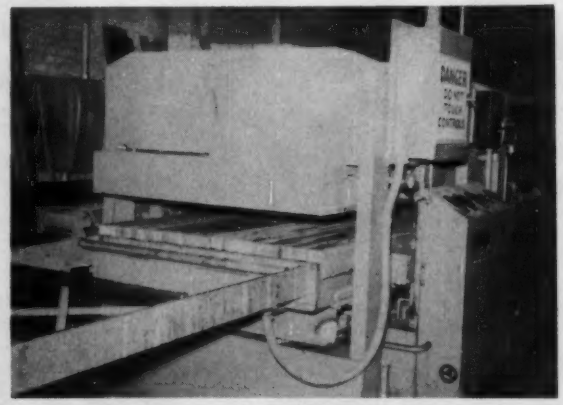
Press Cures Glue Faster

J. H. TARBELL, Industrial Engineer, Kansas City Power & Light Company, Kansas City, Missouri

Glued parts on wood panels are cured in a matter of minutes with the electric steam glue press used at the Rust Sash & Door Co, of Kansas City, Mo. The Berthelson press is large enough to handle four by eight panels as thick as nine inches and is fully automatic, with pre-set timing and temperature control. Heating units which generate the steam to heat the platens total 40 kw. The hydraulic mechanism that actuates the platens is driven by a 6-hp motor load.

A second use for the press was recently discovered. Random lengths of scrap lumber are glued and clamped in the press. Heat and pressure are then applied. A sheet of plywood is glued over this core on each side, producing a panel of great strength, suitable for doors, table tops, and similar purposes. The new product also helps solve the scrap lumber problem.

In order to avoid peak demands on the electric service, the machine is timed to switch on the heating units before the plant begins operating so the platens will be ready when production starts.



With the method formerly used, glued parts were clamped in a hand press. Curing took 12 to 24 hours, tied up equipment, and caused delays in filling orders. Now, orders can be filled almost immediately.

Reflective emblem and number on service car.

Reflective bumper emblem on employee's car.

Public Relations in Action

How "Scotchlite" Works for Public Utilities

REFLECTIVE SHEETING

Public service companies recognize that the need for safety and effective community relations never stops. That's why leading public utilities like the Columbus and Southern Ohio Electric Company choose "Scotchlite" Reflective Sheeting for service equipment identification and protection.

Only "Scotchlite" Sheeting gives 24-hour visibility of emergency units and signs . . . in any kind of weather. Motorists appreciate the nighttime brilliance this unusual product of 3M research gives to barricades, trucks and maintenance cars. And they become increasingly aware of the continual service which typifies today's public utility.

Fleet superintendents, too, appreciate the ease of application and greater durability of emblems and markings made with "Scotchlite" Sheeting.

Once you put "Scotchlite" Sheeting to work for your company, you too will discover how it can help save lives, time and money—and increase public awareness of the service you render. Mail the coupon below for a free booklet, "How distinctive markings work for Public Utilities".

"Scotchlite" is a registered trademark of Minnesota Mining & Mfg. Co., St. Paul 6, Minn. General Export: 99 Park Ave., New York 16, N. Y. In Canada: London, Ont.

PRODUCT OF 3M COMPANY RESEARCH

REG. U. S. PAT. OFF.

SCOTCHLITE BRAND REFLECTIVE SHEETING

Minnesota Mining & Mfg. Co., Dept. NV-8227, St. Paul 6, Minn.

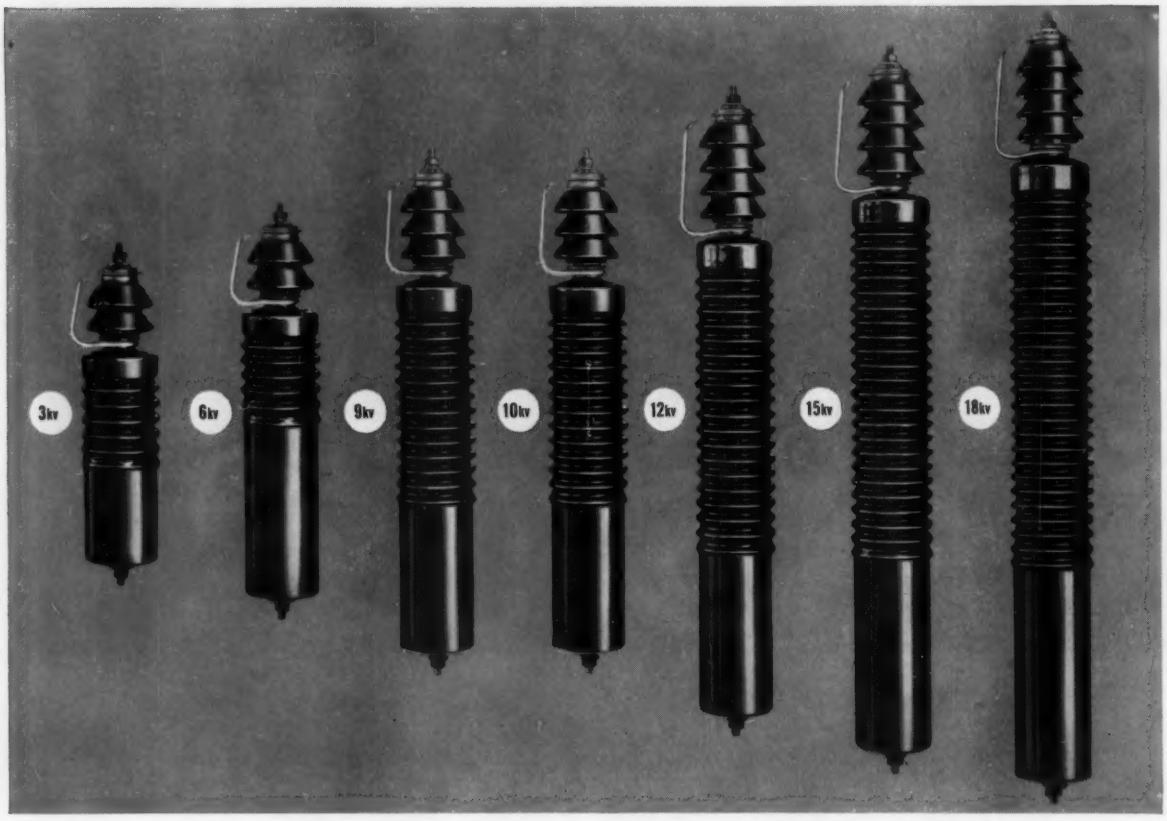
Please send me free booklet, "How distinctive markings work for Public Utilities".

*Name*_____ *Title*_____

*Company*_____

*City*_____ *Zone*____ *State*_____

You get positive protection from line lockouts with these external-gap CRYSTAL VALVE arresters



The famous distribution-type Crystal Valve lightning arrester, containing the exclusive Oxidized-Grain "Crystallite" Valve element, is available in all seven ratings shown above. It represents a half century of experience in developing and producing the finest in lightning protection.

The external gap on the Crystal Valve arrester offers positive protection from line lockouts. The Oxidized-Grain "Crystallite" Valve element, an exclusive feature of Crystal Valve arresters, provides lower unit internal impedance, higher arc-suppressive ability, and increased thermal or surge-current-carrying capacity than ordinary valve elements.

Service records covering thousands of installations show that Crystal Valve external-gap arresters rate better than 99% perfect. To assure virtual elimination of power failures or costly transformer damage due to lightning, specify external-gap Crystal Valve arresters for your power line equipment.

Crystal Valve arresters are available for either cross-arm or tank mounting. For additional information, write Electric Service Works, Delta-Star Electric Division, H. K. Porter Company, Inc., 17th and Cambria Sts., Philadelphia 32, Pa.

ELECTRIC SERVICE WORKS

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.

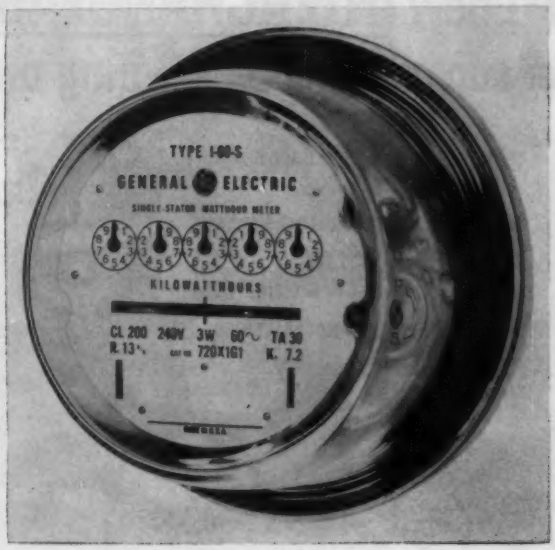
Divisions of H. K. Porter Company, Inc.: Connors Steel, Delta-Star Electric, Henry Disston, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings, and H. K. Porter Company (Canada) Ltd.

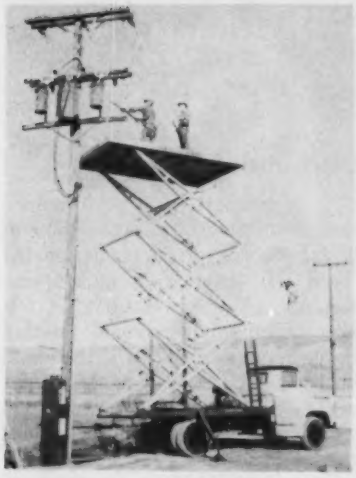
Watthour Meter . . .

. . . **is single-phase model with "on-line" accuracy up to 200 amp.** Called the I-60, it is a 30-amp, 240-v, 3-wire instrument with a 667% overload capacity. At 200 amp, meter is accurate to within 0.75%. Light load accuracy is comparable to that of 15-amp meter.

Stator design uses separate, magnetically isolated electromagnets for voltage and current, in place of combined current and voltage electromagnet. Construction minimizes potential losses, torque reductions, and coil balance errors at heavy load and low p.f. Butyl-insulated current coils move freely on current laminations without affecting calibration. Starting watts average about 22; potential coil power loss is 1.1 w. Other characteristics are: meter torque, 40 gm per mm; speed at 30 amp, 16⅔ rpm; whr constant, 7.2; temperature rise at 200 amp, 52 C; register ratio, 13-8/9.

General Electric Co, Schenectady 5, N. Y.





Elevating Platform . . .

. . . **measures 8 x 14 ft, will lift 1,000 lb up to 70 ft 8 in.** Made of structural aluminum, large platform reduces amount of positioning required, allows worker to use both hands. U-type platform which straddles pole is also available.

Stratolift line includes models with extended heights of 15 ft 8 in; 26 ft 8 in; 37 ft 8 in; 48 ft 8 in; 59 ft 8 in; and 70 ft 8 in. Collapsed height varies from 6 ft to 12 ft 8 in., according to model. Four U-bolts mount lift to truck or trailer. Hydraulic control permits positioning at desired height. Safety features include sealed relief valve and positive mechanical lock. Manual type outriggers are standard, hydraulic ones optional. Other optional features are remote control, extension walkway, platform hoist, and safety rail.

Hydro-Point Engineering Co, P.O. Box 488, Hamilton, Mont.

Megger . . .

. . . **has low resistance, capacitance discharge, and divider circuits** in addition to conventional high resistance measurement range. Four-position switch on Meg type instrument selects any of four applications quickly and easily. Divider or ratio switch divides normal megohm scale by ten. Discharge switch discharges capacitance built up in apparatus during test by opening circuit between measurement circuits and test terminals and shorting terminals to ground. Low resistance ohms scale has range from zero to 10,000 ohms, can be used to check conductor resistance without additional equipment. It can be used in addition to and independently of the megohm scale. Earth, line, and guard terminals are arranged to permit change to ohms scale without changing connections.

James G. Biddle Co, 1316 Arch St, Philadelphia 7, Pa.

Terminators . . .

. . . **splicing fittings, and supports for interlocked armor** cable are available for variety of uses. Eleven types of terminators include watertight, non-watertight, upright, horizontal, and inverted types. Nominal over all diameter ranges from 0.45 to 4.28 in. Combination terminator adapter for cable with waterproof sheath terminates and grounds armor, seals cable at entry to cabinet or pothead.

Sixteen splicing fittings include all materials for two-way, three-way, or four-way splices on varnished cambric and rubber-insulated cable. Maximum voltage ranges

(*Continued on page* 84)

NOW···GLOBE OFFERS···
two new INTERCHANGEABLE trays for support of cables, wiring and tubing

★ Engineered for uniform design and easy installation
★ Steel or aluminum construction
★ Complete accessories for SPEEDIER Installation
★ No sharp edges to damage cables
★ Complete interchangeability

Now, for the first time, two types of cable trays, one a ladder type and the other a basket type, are available to be used INTERCHANGEABLY at any given location, depending on the type and weight of the cables to be suspended. The advantages of each type tray can thus be used to the fullest extent. Globetray, the ladder type, is intended for use where festooning is not a problem, while Cable-Strut, the basket type, is intended for the support of communication wire, instrument tubing and control cables in automation applications.

These two cable trays have been thoroughly field tested in hundreds of large industrial installations, in new plant construction, in power plants, in modernization, and for power distribution in all types of manufacturing processes. A new catalog, just off the press, gives full information and installation techniques. Ask for your FREE copy today.

Distributors are to be found in all principal cities—consult the yellow pages in your phone book under "Gratings" or "Conduits" for the one nearest you.

109

PRODUCTS DIVISION

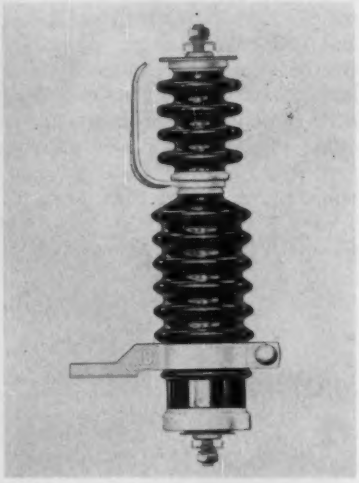
The GLOBE Company MANUFACTURERS SINCE 1914

4030 SOUTH PRINCETON AVENUE, CHICAGO 9, ILLINOIS

Terminations

(Continued from page 83)

from one kv to 15 kv grounded and/or ungrounded neutral and to 5 kv shielded or unshielded. Angle adapters for 45-deg. terminations and terminator mounting brackets are also included in line.
O. Z. Electrical Mfg Co, Inc, 262 Bond St, Brooklyn, N. Y.



Distribution Arrester . . .

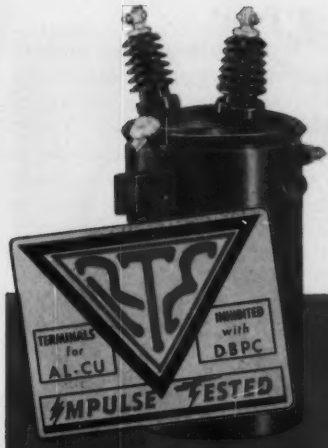
. . . **is compact, high performance unit with** Dynagap construction. These Thorex arresters, designated Type DV, have long interrupting distance. Gap takes 90% of 60-cps power follow current limiting duty, permitting use of valve block design with increased surge current durability to meet long duration disturbances. Line includes ratings from one to 15 kv, uses same gap parts as heaviest duty station types.
Ohio Brass, Mansfield, Ohio

A-C Hour Meter . . .

. . . **gives direct reading of total operating hours of machine** or equipment. Square face meter is suitable for panel mounting, has white face dial with black figures. It is available in 120, 240, or 480-v models. Catalog AC 587B has more data.
J. W. Hobbs Corp, Div of Stewart-Warner Corp, Springfield, Ill.

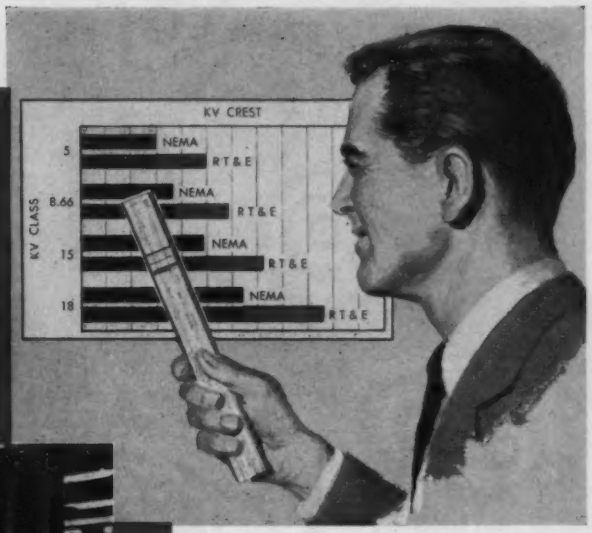
(More New Equipment on page 86)

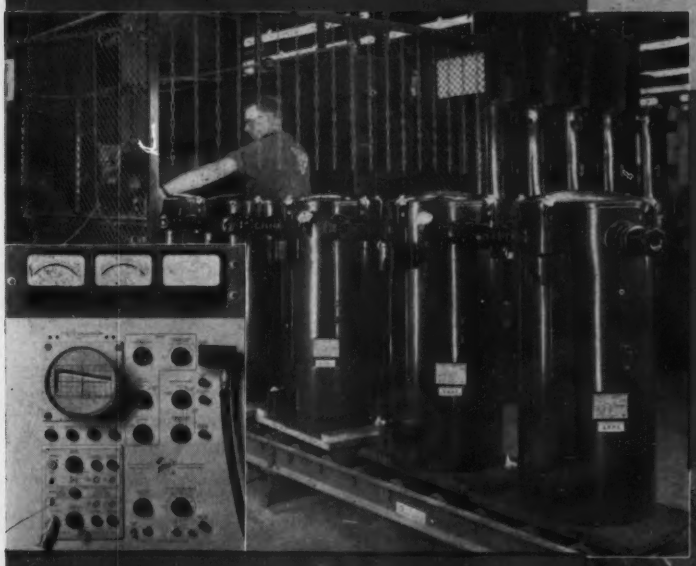
IMPULSE TESTED



DESIGN

High impulse strength in transformers is not attained by accident; it must be considered from the very beginning of design. Such is the case at R T & E, where transformer design is based on impulse withstand levels approximately 50% in excess of NEMA standards.





TESTING

Every R T & E Transformer receives an "on the line impulse test" through use of the most modern equipment and methods known. This test not only insures that the transformer meets NEMA impulse level requirements but also rejects those transformers that are not of maximum quality.

OPERATION

Naturally, the ultimate in testing is provided "on the system", where nature subjects the transformer to the most rigorous tests. R T & E Transformers have been thoroughly proven in operation in every climate of the U. S. They have been awarded the invisible seal of customer satisfaction, proved by a growing list of customers who specify R T & E.

R T & E CORPORATION
WAUKESHA, WISCONSIN

Helping provide power for America

FRAMELESS

CADWELD® MOLDS

Eliminates All Frames

NEW E-Z CHANGE Handle Clamp fits directly into graphite mold — simplifies your equipment for making CADWELD Electrical Connections.

IN LESS THAN 3 SECONDS — change from one mold type to another.

DRASTICALLY REDUCES INVENTORY COSTS — E-Z CHANGE Handle Clamps are manufactured in just two sizes (one for 3" molds — one for 4" molds). One of each size will handle 95% of all types of STANDARD CADWELD Connections.

New molds are furnished complete with attached cover.

NO LOSS IN INVENTORY — NEW molds will fit STANDARD or QUICK-CHANGE frames you now have in stock.

CADWELD®

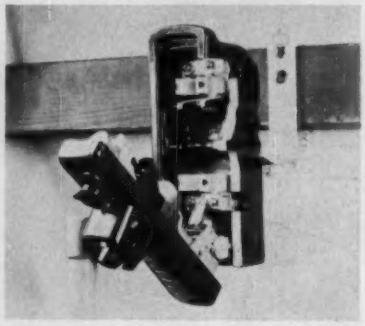
Erico Products, Inc.

2070 E. 61st Place Cleveland 3, Ohio

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario

Tower Paint . . .

. . . **is self-priming and durable,** may be used on transmission towers, substation structures, corrugated buildings, and chain link fences. Known as Synchron Tower Gray, it is composed of metallic and rust-inhibiting pigments. It dries to semi-gloss finish resembling weathered galvanized iron. Bulletin No. 4630 has complete data.
M. J. Merkin Paint Co, Inc, Industrial Dept, 1441 Broadway, New York, N. Y.



Loadbreak Feature . . .

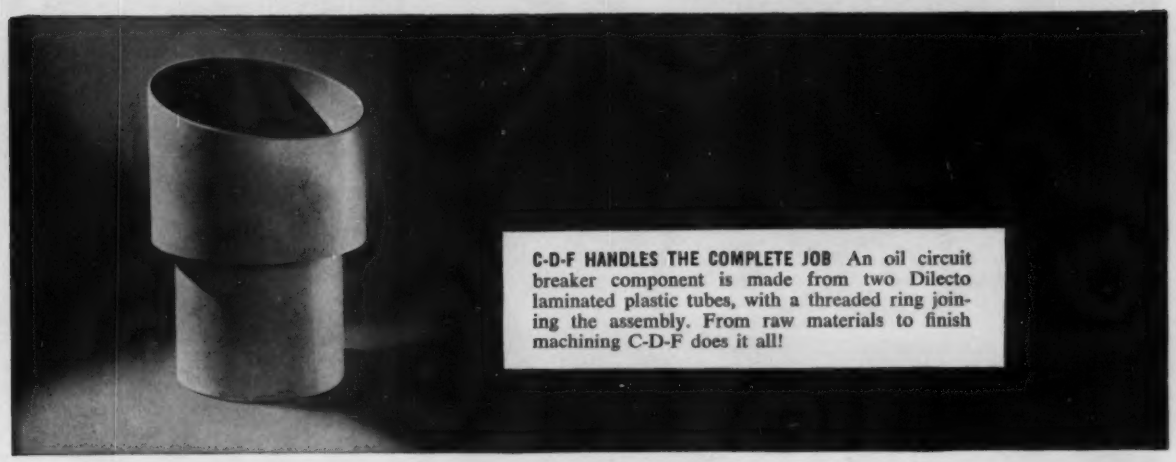
. . . **makes full-load switching device out of 100-amp enclosed fuse cutouts.** When cutout door is opened, arc at lower terminal burns through tip of replaceable cylinder, releasing high pressure blast of insulating gas which blows out arc. Oscillograph tests indicate all voltages within rating are interrupted in three to seven cycles.

Cylinder is replaced after each operation, comes in plastic clips of six which can be hung on lineman's belt or tacked to pole near the cutout. Loadbreak is operated by opening door with switchstick in normal manner and does not interfere with overcurrent protection function of fused cutout. Individual lines may be disconnected without disturbing rest of system.
General Electric Co, Schenectady 5, N. Y.

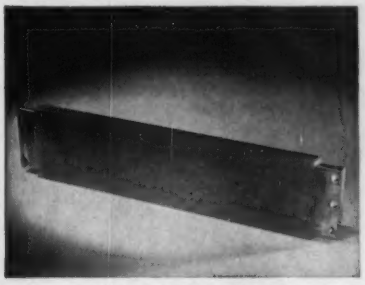
Strip Chart Recorder . . .

. . . **with small case cuts mounting space** needs by 50%, permits three units to be mounted in space normally occupied by two. Available

(*Continued on page* 90)

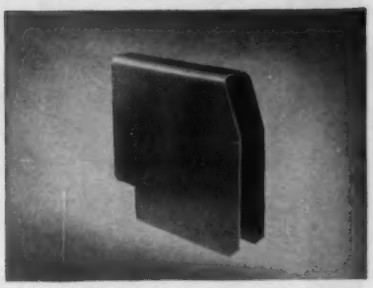


C-D-F HANDLES THE COMPLETE JOB An oil circuit breaker component is made from two Dilecto laminated plastic tubes, with a threaded ring joining the assembly. From raw materials to finish machining C-D-F does it all!



C-D-F KNOWS HOW TO MACHINE PLASTICS. A bus bar gets a covering of molded Dilecto over copper supplied by the customer. The plastic ends are skillfully trimmed on a smooth saw.

C-D-F MOLDS MANY SPECIALTIES. This shaft insulator for a circuit breaker is molded from C-D-F's cloth-based industrial thermosetting plastic, Celoron. Note complexity of mold, clean detailing.

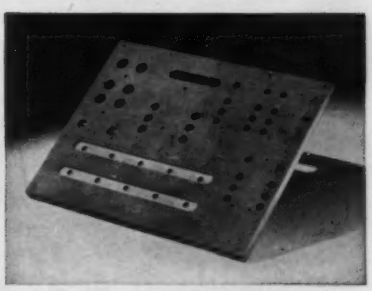


C-D-F USES MODERN METHODS. Large quantities of arc chute barriers are made from paper-based Dilecto. Operations include pressing, cutting, post-forming and trimming.

Dependable equipment relies on C-D-F insulation!

C-D-F OFFERS UNIQUE MATERIALS. This contact shaft for an air circuit breaker is another example of molded C-D-F Celoron used in switchgear because of its high impact strength.

C-D-F IS A SKILLFUL ASSEMBLER. Made from Grade C rolled Dilecto tubing, these pots are turned, bored, slotted. Then a macerated plastic end is inserted and arc resistant varnish finish applied.



C-D-F UNDERSTANDS THE ELECTRICAL INDUSTRY'S NEEDS. Precisely machined to close tolerances, Dilecto panel boards guarantee dependable insulation, help designers save space.

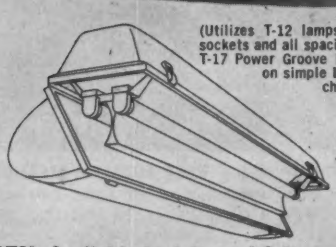
See our catalog in Sweet's Design File for basic product data and sales offices. Write for detailed information, or send us your print for quotation.

CDF

CONTINENTAL-DIAMOND FIBRE

A SUBSIDIARY OF THE Budd COMPANY • NEWARK 15, DELAWARE

Still another Westinghouse



(Utilizes T-12 lamps. Has sockets and all spacing for T-17 Power Groove lamps, on simple ballast change.)

2FSL Available in 4-ft. and 6-ft. models

1. Fiber-Glass Housing contains ballast — is impervious to impact, corrosion! Never needs painting! 2. Acrylic Plastic Globe is unaffected by weather, never discolors, warps or cracks! Improved gasket is "sponge" foam Vinyl! 3. Reflectors are specially high-polished, finshed by famed Alzak Process — give maximum light output from the lamps employed! Open either way. Easiest installation! 4. Cast-Aluminum Slip-Fitter has 7° adjustment. Quickest leveling! 5. 2-Way Latch-and-Hinge Assembly opens either way. Fast maintenance! EVERY REFINEMENT REQUESTED BY FOREMOST LIGHTING ENGINEERS!

street lighting achievement!

BETTER LIGHTING NOW
FOR SECONDARY STREETS...BY

5 MAJOR IMPROVEMENTS IN NEW 2-FSL FLUORESCENT LUMINAIRE!

Broader areas are bathed in natural, low-glare "high-visibility" light! All five specific refinements acclaimed by recognized Lighting Engineers!

All the outstanding success of today's modern lighting of primary streets—produced by the famous Westinghouse 4FSL (4-lamp) fluorescent luminaire—is now available for secondary business streets and important suburban thorofares!

Westinghouse has created a new, 2-lamp luminaire—the 2FSL—that capitalizes more completely than ever before on the use of tubular fluorescent light-source for street illumination.

This engineering of the 2FSL encompasses 5 distinct improvements. They are advancements providing unprecedented lighting efficiency, remarkably long service life, and speed and ease of application, installation and maintenance unparalleled in the past!

1. **Housing of Doubly Reinforced Fiber-Glass** is corrosion-free!—impervious to impact! *Cannot* dent! Permanent color is molded through. *No painting* is *ever* necessary! Wide flange creates ideal gasket seat and water shed!
2. **Globe of Acrylic Plastic** is light in weight but *extra* durable. Will not discolor, warp or crack. Is unaffected by weather, temperature or ultra-violet rays. Flanged edge "mates" with housing by specially seated "sponge" foam Vinyl gasket.
3. **Specular Aluminum Reflectors** are specially high-polished!—finished by the famed Alzak process! Deliver *maximum* light output from the lamps employed, with "ideal" light distribution! Assembly opens from either side for easiest access, simplified mounting and wiring to terminal block.
4. **Cast-Aluminum Slip-Fitter** accommodates 2" pipe, extending full 13" into housing, quickly secured by special clamp. Allows complete 7° adjustment — providing quick and easy leveling.
5. **New, 2-Way Latch-and-Hinge Assembly** simplifies maintenance. Permits globe to open either way. Stainless steel latches and springs (2 pair on 4-ft. unit, 3 pair on 6-ft. model) maintain *secure* gasket seal!

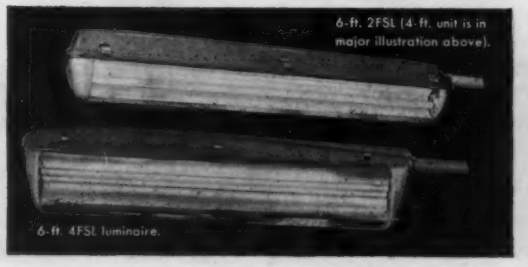
This new 2FSL luminaire incorporates every development proved superior by Westinghouse—acknowledged to be the nation's foremost authority on modern street-illumination.

ACCURATE, FORTHRIGHT ANALYSIS OF EVERY STREET-LIGHTING PROBLEM. SOUNDEST RECOMMENDATIONS AT LOWEST PRACTICAL COST!

Westinghouse makes scientifically superior luminaires for *every type application!* — that most efficiently utilize *every type of light source!*

Westinghouse Lighting Specialists, therefore, *always* recommend *only the best possible system!* — for *each specific* street-lighting situation! — *consistent with* the *lowest possible costs that are practical today!* J-04411

YOU CAN BE SURE..IF IT'S Westinghouse



Safety for the hot-line jobs...

KEARNEY
Hi-Line
Jumper Clamp

Recommended for use on all maintenance, repair or construction jobs that can be safely performed by a lineman wearing rubber gloves.

Handles made of high dielectric strength, paper base, ⅛" thick bakelite... highly resistant to cuts and punctures, will not deteriorate with age. Will take 10,000 volt jumper cable (cable not furnished with clamps). Area covered with KEARNEY Non-Slip Surfacer assures secure grip on handle. Abrading or scoring the conductor when tightening the handle is eliminated by non-rotating floating ring located in top end of handle and keyed to the clamp head.

Threaded ferrule jumper terminals recommended. Lock nut keeps terminal from backing out of clamp.

-360

JAMES R. KEARNEY CORPORATION • General Offices: 4224-42 Clayton Ave., St. Louis 10, Mo.

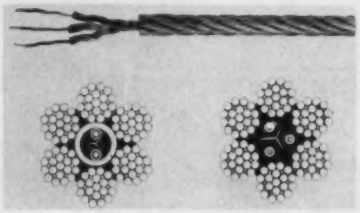
for BETTER CONSTRUCTION
SAFER MAINTENANCE
Specify KEARNEY PRODUCTS

Plants at: ST. LOUIS • FAYETTEVILLE, ARK. • SHENANDOAH & CLARINDA, IA. — GUELPH, ONT., CAN.

Strip Chart Recorder

(*Continued from page* 86)

for measuring and controlling temperature, speed, or millivolts, the Model 6731 provides all control forms, including full throttling and time proportioning control, both with automatic reset and approach rate. Simple, plug-in range clips facilitate range changing in the field. **Weston Electrical Instrument Corp, Newark 12, N. J.**



Signal Carrier Wire Rope...

. . . **has copper signal conductor in core.** In hoist and operating cable applications, it allows voice or signal communication through the cable itself, eliminates need for separate communication line. Known as SignalKore, it can be used either with standard phones or with sound-powered equipment.

Rope diameters include 11 sizes from 0.75, through 2.0 in. For smallest diameter, breaking strength is 42,840 lb for galvanized finish, 47,600 for bright and Galacco finish. In 2-in. diam, breaking strengths are 288,000 lb for galvanized and 320,000 lb for bright. Three smallest sizes have two conductors in core; all others, three. **American Chain & Cable Co, Inc, Wire Rope Div, Wilkes-Barre, Pa.**

Fire Extinguishers . . .

. . . **are simple to operate,** have recessed pressure gauge which shows when unit is charged and ready for use. Portable, pressurized, dry chemical models, with 20 and 30-lb capacities, may be used on liquid or electrical fires. Special baffle reduces discharge velocity without reducing range. Operation is self-evident; horn is aimed at fire and trigger pushed to operate them. **Walter Kidde & Co, Inc, Belleville, N. J.**

Protective Hand Cream . . .

. . . **leaves no conducting film** on electrical equipment, can be used by workers in electrical assembly and repair operations without danger of dielectric failure. Known as Utility Cream No. 2, it is composed of silicones, and is medically safe.
Silatone Products Corp, P. O. Box 92, Dunellen, N. J.

MORE NEW PRODUCTS

Type 6800 **r-f power triode,** designed for induction or dielectric heating or similar heavy duty applications, delivers 20 kw at frequencies up to 30 Mc—Amperex Electronic Corp, 230 Duffy Ave, Hicksville, L. I., N. Y.

Two-pole, 19-frame, permanent-split capacitor **motor,** rated 1/40 or 1/20 hp, is intended for small business machines. Designated Type FL the 3,200-rpm motor runs on 115 or 230 v and has low maintenance due to lack of brushes and governors.—Westinghouse Electric Corp, Box 2278, Pittsburgh, Pa.

Hydraulic brake measuring 6 x 3 inches is useful for service braking and accurate load spotting on light cranes and similar equipment.—Wagner Electric Corp, 6400 Plymouth Ave, St Louis 14, Mo.

Terminal block permits combinations of seven different types of terminals, with capacities from 30 to 250 amp, on same factory-assembled block—Curtis Development & Mfg Co, Milwaukee, Wis.

Magnetic clutch in sizes from two to 13 inches have fast engagement and disengagement for machine tools and other industrial uses—Fawick Airflex Div, Fawick Corp, 9919 Clinton Rd, Cleveland 11, Ohio

Intermatic T-Rated **time switches** for heavy duty incandescent lighting loads handle momentary surges up to eight times normal current rating —International Register Co, 2626 W. Washington Blvd, Chicago 6, Ill.

(More New Products on page 92)

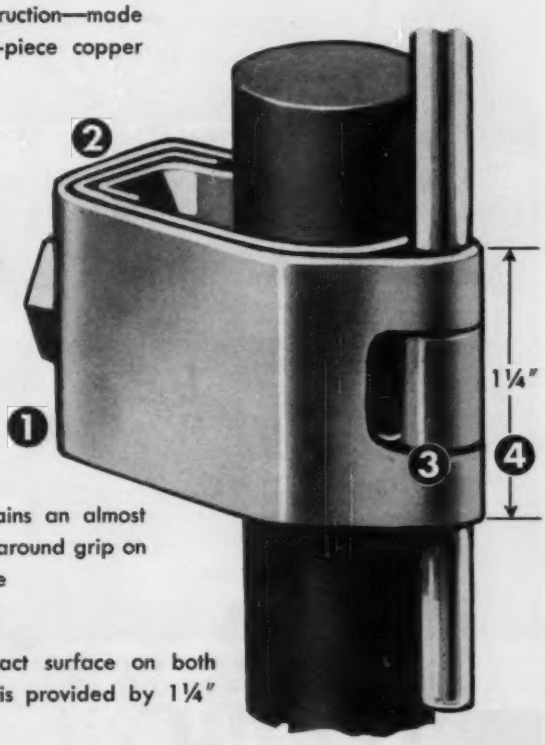
Constant clamping force!

KEARNEY
Clamp-Tite
Ground Clamp

The standard item in the field for many years—because it does the job so well! Will not loosen under vibration or extremes of expansion or contraction—grips both ground wire and rod securely.

1. Sturdy construction—made of heavy, one-piece copper strip

2. Spring action exerts strong, constant clamping force



3. Clamp obtains an almost completely all-around grip on the ground wire

4. Large contact surface on both wire and rod is provided by 1¼" body width

-357

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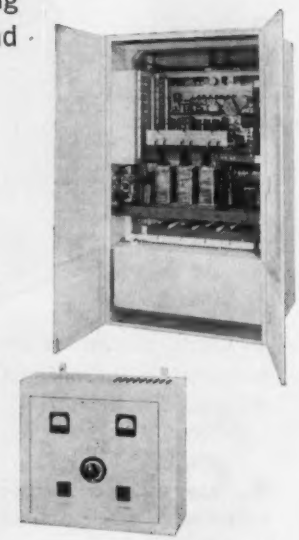
INET

BATTERY CHARGERS

BATTERY CHARGERS

GUARANTEE UNFAILING RELIABILITY

You get built-in reliability guaranteed to give trouble-free performance year after year. Magnetic amplifier controlled with absolutely no tubes, no wearing or moving parts. Just plug it in and forget it. Completely automatic.



There's a custom-built Inet Regulated Battery Charger for every requirement. Write for Bulletin, *Battery Chargers.*

BATTERY CHARGERS **LEACH** *CORPORATION/INET DIVISION*

4441 So. Santa Fe Ave., Los Angeles 58, California

District Offices and Representatives in Principal Cities of U. S. and Canada

More New Products

(*Continued from page* 91)

Parallel connected **main and range panel,** rated 150 amp, is designed for use in the meter-switch-fuse sequence for 120/240-v, 3-wire, single-phase service—Federal Pacific Electric Co, 50 Paris St, Newark 1, N. J.

Rota-Beam **warning lights** come in 6 and 12-v models. Units plug into auto cigarette lighters, develop approximately 3,000 cp—Pyle-National Co, 1334 N. Kostener Ave, Chicago 51, Ill.

Pneumatic **timing relay** small enough for machine tool control panels may be used up to 600 v ac. Timing range is adjustable from 0.2 sec. to 3 min. Similar d-c version is available.—Square D Co, 4041 N. Richards St, Milwaukee 13, Wis.

Solid or stranded No. 22 AWG **hook-up wire** has Synthinol covering, does not require overbraid or thick jacket—Rome Cable Corp, Rome, N. Y.

Fusible, **200-amp main disconnect** for residential use combines advantages of fuses and circuit breakers. Breaker branch circuits are rated 15 to 50 amp.—Wadsworth Electric Mfg Co, Covington, Ky.

All-purpose lantern with half-mile carrying power has focusing lighthead and double-powered dry battery, can be used for emergency and night work.—Burgess Battery Co, Freeport, Ill.

High temperature **solder,** No. 805, and **flux,** No. 66, are used to join aluminum to copper, steel, or brass. Solder is 95% zinc, 5% aluminum, melts at 715 to 725 F. Flux can be used dry or with alcohol.—Aluminum Co of America, Alcoa Bldg, Pittsburgh, Pa.

Meco-tronic electronic **motor controller** protects any motor against overload and automatically allows mechanism to operate when overload is removed—Manufacturers Equipment Co, 218 Madeira Ave, Dayton 4, Ohio.

(*More New Products on page* 96)

Control section of Kellogg's electronic computer.

Electronic Route to Lower Steam Power Piping Costs

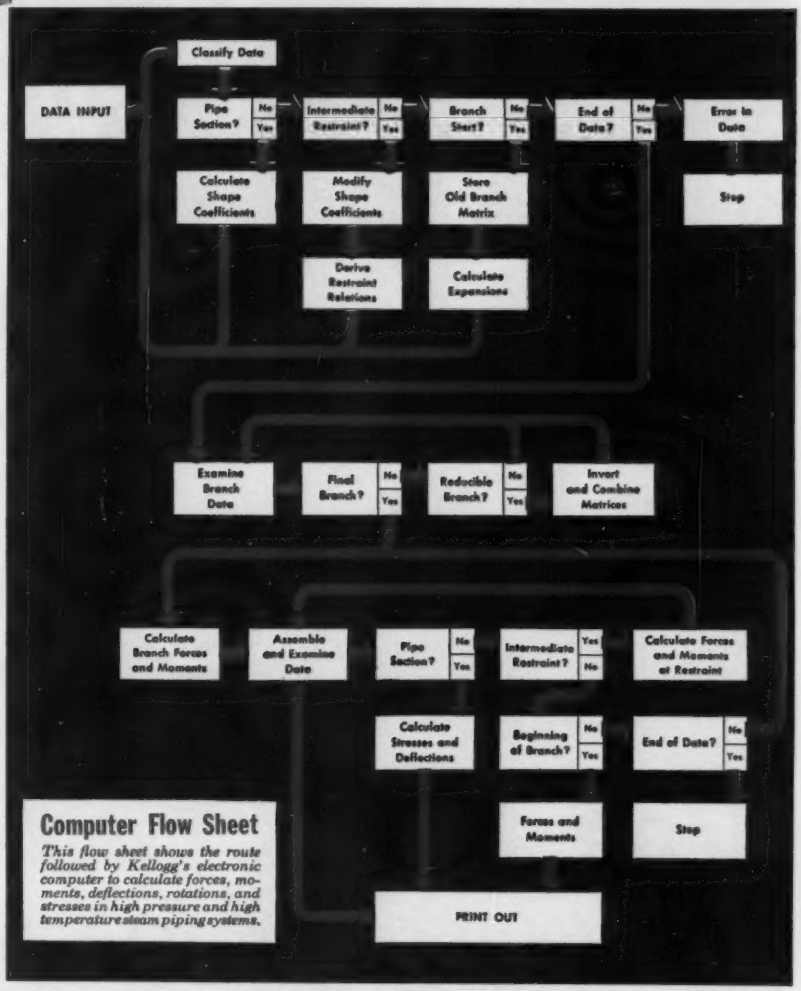
Kellogg's Digital Computer Permits More and Faster Accurate Flexibility Analysis of Complex Main and Reheat Piping Systems

KEEPING PACE with the increasingly critical pressures and temperatures of the modern steam-electric power plant are M. W. Kellogg's advanced techniques for pre-determining stresses and reactions of main and reheat piping. Most recent addition is a large magnetic drum digital computer, used to calculate forces, moments, deflections, rotations, and stresses in complex piping systems.

By enabling Kellogg engineers to undertake a far greater number of calculations in less time than ever before, electronic computation makes possible the ultimate or near ultimate piping system designs. Pipe runs can often be shortened without sacrificing required margins of safety; capital investment and maintenance costs reduced; operating efficiency increased.

A pioneer in flexibility analysis techniques, which include manual calculations, model testing, and a smaller electronic computer, Kellogg continues its pioneering in the power piping industry by the addition of this high speed computer to its New York engineering facilities.

A cordial invitation to see the M. W. Kellogg electronic computer at work is extended to consulting engineers and to engineers of power generating companies and their equipment manufacturers. Appointments may be made through the Sales Manager, Fabricated Products Division.

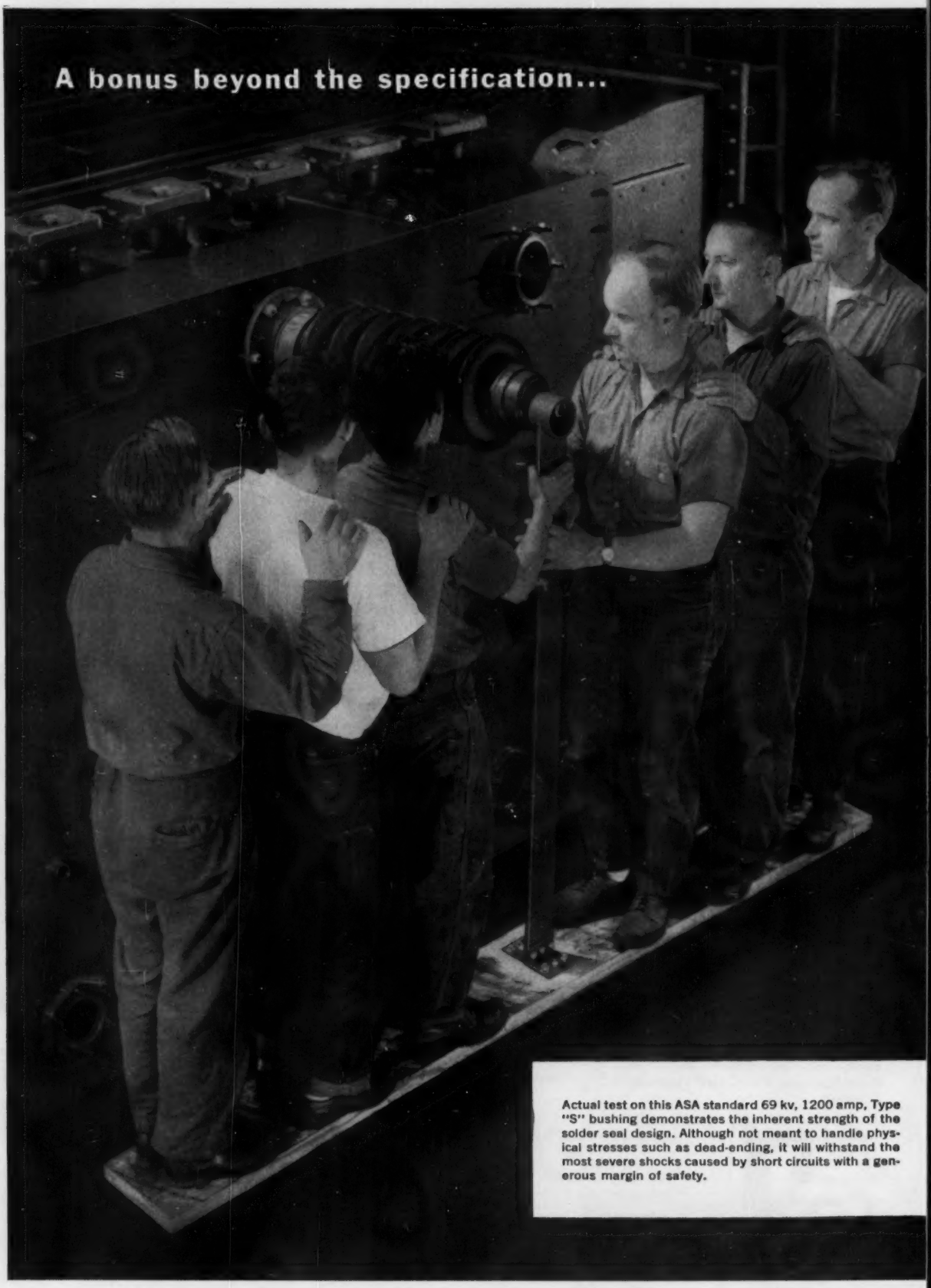


Computer Flow Sheet

This flow sheet shows the route followed by Kellogg's electronic computer to calculate forces, moments, deflections, rotations, and stresses in high pressure and high temperature steam piping systems.

FABRICATED PRODUCTS DIVISION
THE M. W. KELLOGG COMPANY, 711 THIRD AVENUE, NEW YORK 17, N. Y.
A SUBSIDIARY OF PULLMAN INCORPORATED
The Canadian Kellogg Company Limited, Toronto • Kellogg International Corporation, London • Societe Kellogg, Paris
Kellogg Pan American Corporation, New York • Companhia Kellogg Brasileira, Rio de Janeiro
Compania Kellogg de Venezuela, Caracas

POWER PIPING—THE VITAL LINK



Actual test on this ASA standard 69 kv, 1200 amp, Type "S" bushing demonstrates the inherent strength of the solder seal design. Although not meant to handle physical stresses such as dead-ending, it will withstand the most severe shocks caused by short circuits with a generous margin of safety.

SOLDER SEAL . . . stressed to the ultimate without damage

For transformers and circuit breakers . . . durability like this can't "just happen" . . . it has to be planned

Engineered to withstand severe electrical, thermal and mechanical stresses, Westinghouse condenser bushings can take far more punishment than they will ever get.

The result of fifty years' field experience plus continuous research, Westinghouse Type "S" bushings needed no basic construction change to meet ASA standards.

Superiority has been proved in service with such features as:

Unequaled Mechanical Strength—provided by exclusive Westinghouse solder-sealed construction, together with one-piece, wet-process porcelain casing. This allows deflection under severe short circuit stresses without damage to sealed joints.

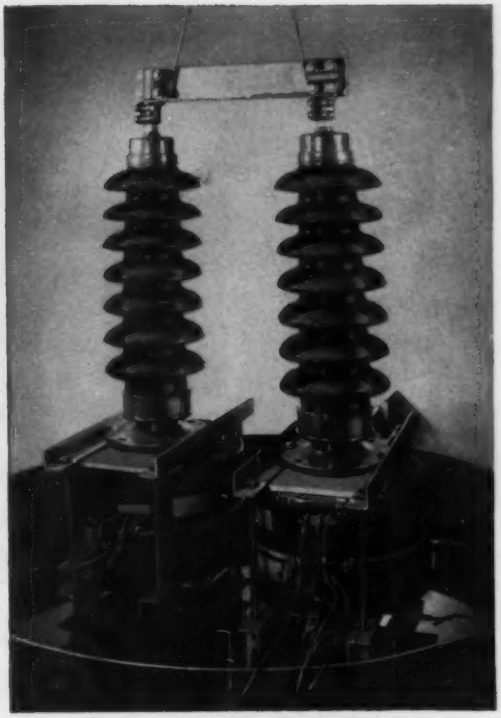
High Dielectric Strength, Low Power Factor—provided by numerous conducting foil layers, and generous thickness of high-grade insulating paper.

Extra Thermal Strength—assured by liberal conductor cross-section and low dielectric loss. High thermal capacity, no hot spots.

Absolute Sealing Against Moisture—provided by solder seal construction which eliminates gasketed joints. High-viscosity plastic filler gives additional internal protection by providing a positive bond which prevents voids at all temperatures.

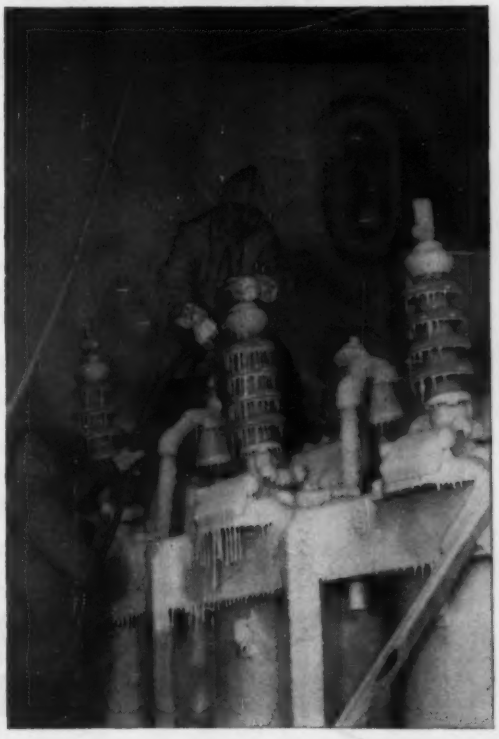
Freedom From Corona—maintained by uniform voltage gradient and controlled by testing every bushing.

For complete information about Type "S" condenser bushings, call your Westinghouse representative . . . or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70815



Exceptionally severe thermal stability test fails to decrease bushing strength. Tested by 12 hours immersion in hot oil at full rated current, one hour at twice normal voltage.

Work-worthy under any temperature extreme. In the Type "S" bushing, exclusive Westinghouse filler plastic eliminates voids at all points and at all temperatures down to –60°F.



YOU CAN BE SURE . . . IF IT'S

Westinghouse

Pictured (left to right) Alfred Scheer, Shaw, Metz & Dolio electrical engineer; George Nejdl, asst. electrical engineer for Shaw, Metz & Dolio; P. R. Ellingson, plant engineer, Johnson Motors; R. S. Terhune, Nelson sales representative.

NELSON

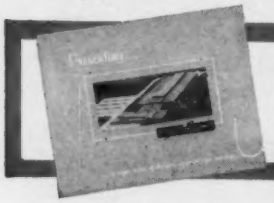
helps make your Johnson outboard motors

Seven Nelson unit substations similar to the one pictured above were used in the new Johnson Motors die cast expansion at Waukegan, Illinois. Each unit, compactly designed for ease of operation and maintenance, controls the flow of power to a section of the plant.

The unit shown is substation No. 3. This is a 1,000 KVA unit, rated 12,000 volt delta primary to 480 volt Wye 277 volt secondary, and incorporating Nelson Class 722 low voltage switchgear. This gear includes 1 — 50,000 AIC main and 8 — 25,000 AIC feeder breakers, and has fully equipped spaces for five additional future feeder breakers.

Thanks to the close cooperation on the part of Shaw, Metz & Dolio, architects and engineers of Chicago, the engineer at Johnson Motors, and the contractor, Aldridge Electric Company with Nelson Electric Manufacturing Company, this installation was made to the *complete satisfaction* of all parties.

When you need any type of electrical control equipment, consult NELSON. The type of team work that made the Johnson Motors installation possible can help you streamline your plant for more efficient operation.



To learn more about Nelson Electric Manufacturing Company please write for pictorial index and brochure describing our new plant.

a major source of electrical control equipment for industry

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

More New Products

(*Continued from page* 92)

Safety solvent SS-25 has no flash at boiling point. It can be used to clean and degrease electrical equipment without harming rubber or enamel insulation.—National Disinfectant Co, 2417 Commerce St, Dallas, Texas.

Remote starting, **50-kw electric plant** for standby power is gasoline powered. Line includes 120/208, 115/230, and 230-v models—Kohler Co, Kohler, Wis.

Oil-tight **pilot light** is highly resistant to chemicals and abrasion, comes in five colors and clear glass —Square D Co, 4041 N. Richards St, Milwaukee 12, Wis.

Continuity tester heavy duty flashlight has special cap and 2 clip leads for checking de-energized wiring, controls, motors, and similar equipment—Ray-O-Vac Co, Madison 10, Wis.

Channel-Flo 2-stage **air compressor** has small space requirements. Compressor is flange mounted on motor. 1.5 and 2-hp models are rated 200 psig—Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y.

Combination **power and lighting distribution boards** have maximum ratings of 240 v ac with 600 amp mains. Combinations of single, 2-, 3-, and 4-pole breakers up to total of 54 poles are available.

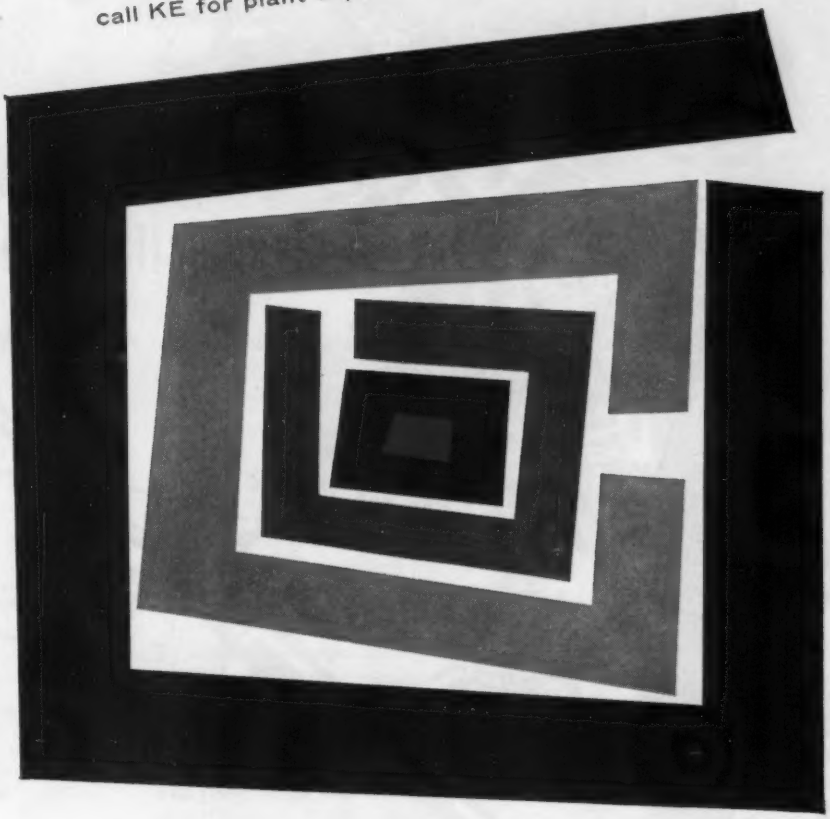
Light duty, double-throw, emergency power **transfer switch** is a no-fuse, 3-pole, solid neutral device, rated 100 amp at 120/240 v ac.

Style HCI **disconnects** have telescoping, adjustable shafts which compensate for difference in depth of disconnect and enclosure without use of supporting shafts. 30, 60 and 100-amp ratings have 2-inch range; 200-amp rating, 5-inch range.

Twin plug-in **circuit breakers,** rated 15 and 20 amps, allow installation of up to twice normal number of circuits in load centers.

Circuit **breaker load centers** with 20 to 40 branch circuits and ratings from 40 to 200 amp are offered in flush, rain-tight, and surface enclosures—General Electric Co, Plainville, Conn.

call KE for plant expansion or new facilities



call KE for plant expansion or new facilities

call KE for plant expansion or new facilities

INGENUITY

has made KE the experienced leader in nuclear projects

Engineering Test Reactor, National Reactor Testing Station, Idaho. Designed and built by KE—on schedule and within estimate!

The Engineering Test Reactor, Food Irradiation Reactor, Hanford Production Reactors, Aircraft Nuclear Propulsion Testing Facilities—these represent some of the nuclear energy projects performed by Kaiser Engineers. In each case, KE ingenuity produced efficient, lower cost facilities.

KE's Nuclear Engineering Division has the highly specialized skills and experience required to undertake complete design and construction of nuclear research, production or power generating facilities. Call KE for planning or building your nuclear project.

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MANAGEMENT NEWSLETTER

An ounce of scientific prevention

Like the dramatic progress in medical science, modern tree care bears little resemblance to the crude methods of only fifty years ago. No longer is it enough to repair damage—to cut away a limb that has died. Today, as always, we seek the answer "Why"—the cause of the damage or disease and apply every modern technique and curative treatment. Only in this way can America's rich heritage of shade trees be preserved.

Scientific tree care is available to you through your local Bartlett representative, a highly skilled technician backed by the knowledge and experience of the Bartlett Tree Research Laboratories. If you have trees which you value, it will pay you to consult him before you need him. No one knows better than a Bartlett client, that an ounce of scientific prevention is worth many many pounds of cure.

REMEMBER

Our long experience in working with both utilities and the public is your assurance of dependable work and good customer relations.

1907-1957 The Bartlett Way 50 years Progress in Scientific Tree Care

BARTLETT TREE EXPERTS

Home Office, Research Laboratories and Experimental Grounds, Bartlett School of Tree Surgery, Stamford, Conn. Local Offices from Maine to the Carolinas, and West to Indiana. See your Local Telephone Directory for Local Address.

ELECTRICAL BUSINESS OUTLOOK

Electrical World
AUGUST 5, 1957

Keep an eye on population growth and what it means for the future. Right now the U. S. is booming along with about 171 million people. That represents a jump of 27 million or almost one-fifth in the last decade.

Note distinctive characteristics of current population growth. Over the past 10 years, the number of 18-year-olds and under has increased 37%. There are 31% more persons aged 65 or over. But the 18-64 age group has grown by only 8%. In short, because of a low birth rate in the 30's, the population is now bulging at the ends rather than in the middle.

Market patterns shifted in the past because of these trends. One striking example is the number of household formations. While in 1948-50 the yearly average was 1.4 million, in 1954-56 it dropped to 800,000. This has undercut the basic demand for homes, appliances, and house-furnishings.

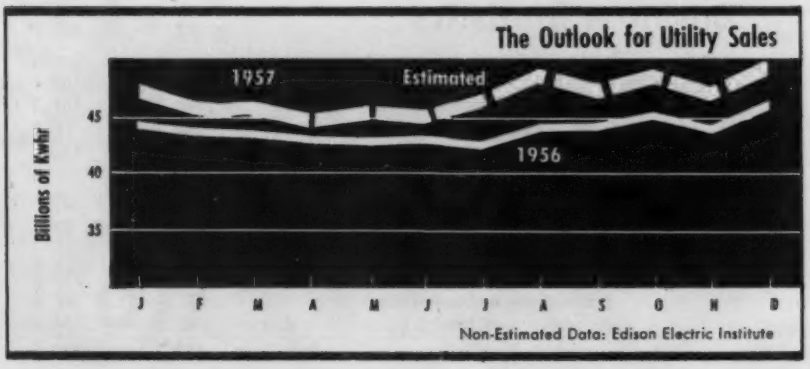
Changes in age composition will become even more significant over the next 10 years. Two points which a forward-looking management might bear in mind:
1. By 1965, there will actually be fewer persons aged 25-44 than in 1955.
2. Half of the 10 million persons entering the labor force in the next 10 years will be women.

By 1965 total population will hit an estimated 193 million—and by 1975, 230 million. And actual figures could well be higher. As one economist put it a few years back: "Unlike the steel industry, the mothers of the U. S. cannot be meaningfully rated as to total capacity."

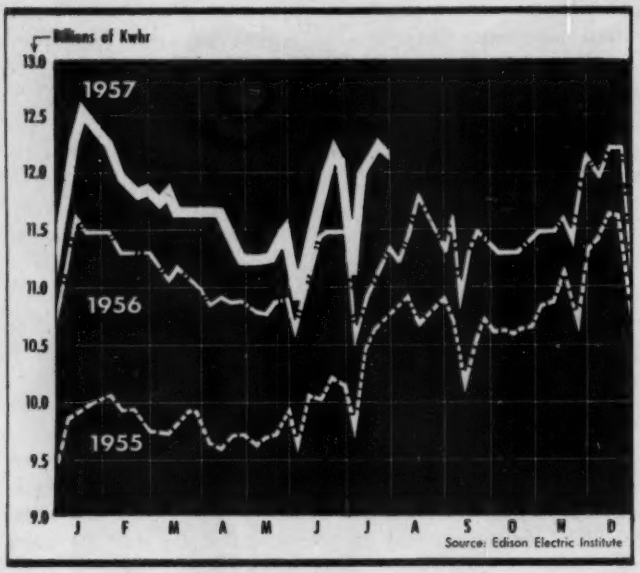
The baby boom and added longevity are influencing utility plans. These factors and Electrical World's forecasts of some 8,000-kwhr average annual residential use by 1970 already find the industry planning record capital expenditures.

Outlay for new plant and equipment next year will hit about $5.3 billion for the electric utility industry. This all-time high is some 13% above the $4.8 billion being spent in 1957, according to preliminary analysis of EW's Sept. 2 Forecast Issue. Private companies will spend about $4 billion on capital improvements in 1958.

And generation expenditures will rise proportionately. Although a good part of next year's record plant expansion is reflected in 1957 budgets, generation expenditures should increase to about $2.5 billion in 1958—a gain of approximately 17% over this year. About $402 million of this will go for final payments on new turbine generators.



STATISTICS



OUTPUT

Week ended July 27,
12,243,000,000 Kwhr
Up 8.4%

Per Cent Change From Previous Year

	July 13	July 20	July 27
Total U. S.	+10.0	+10.6	+ 8.4
New Eng.	+ 2.3	+ 7.4	+ 5.5
Mid. Atlan.	+ 6.2	+ 8.9	+ 8.1
Cent. Ind.	+11.9	+12.4	+10.3
West Cent.	+18.6	+23.9	+15.1
Southeast	+ 7.7	+ 6.1	+ 4.5
South Cent.	+14.5	+14.3	+13.0
Rocky Mount.	+ 6.4	+ 8.0	+ 4.7
Pacific			
NW	+ 7.0	+ 9.1	+ 8.0
SW	+13.0	+10.2	+ 6.9

Seasonally Adjusted Index 230.7
Week Ago 233.7
Year Ago 213.0

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 10.1%.

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	May	122.79	122.27	117.43	4.6
Peak—Class 1 Systems. million kw	May	97.8	97.7	92.8	5.4
Estimated Dec. '57 Peak	May	113.6	113.8	114.3	− 0.6
Production—billion kwhr	May	51.70	50.67	49.09	5.3
Hydro		11.80	12.05	11.71	0.8
Fuel		39.90	38.62	37.38	6.7
Sales—billion kwhr	April	47.15	47.75	44.58	5.8
Residential		12.72	13.47	11.86	7.3
Commercial		7.25	7.35	6.71	8.0
Industrial		24.66	24.44	23.60	4.5
Other		2.52	2.49	2.41	4.6
Fuel Consumption	May				
Coal—million tons		12.60	12.50	12.05	4.6
Oil—million barrels		6.31	6.47	4.47	41.2
Gas—billion cu ft		108.66	98.80	110.51	− 1.7
Net Income Class A & B Co's—$ million	May	101.75	115.93	102.50	− 0.7
Residential Customers—millions	12 mos.	46.06	45.99	44.76	2.9
Revenue per kwhr	ended	2.58¢	2.59¢	2.62¢	− 1.5
Avg kwhr per customer	April 30	3,034	3,021	2,838	6.9
Avg annual bill		$78.28	$78.24	$74.36	5.3

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	June	143	143	141	1.4
ENR Construction Cost	July	151.8	151.2	145.6	4.3
BLS Cost-of-living	June	120.2	119.6	116.2	3.4
New Orders for Machinery (1950 = 100)	June	155	149	154	0.6
NEMA Sales					
Insulation materials	May	148	145	158	− 6.3
Electric appliances		88	83	103	−14.6
Wholesale prices	May				
Motors and generators		141.3	141.4	132.1	7.0
Transformers and regulators		147.7	147.4	137.5	7.4
Switchgear and fuses		165.9	164.4	151.2	9.7
GNP—annual rate—$ billion	2nd Qtr.	433.5	429.1	410.8	5.5

MANAGEMENT BULLETIN

FINANCE

Financial people in electric utilities can now breathe easier as the Treasury's $23.9 billion refunding program is practically accomplished. About 95½% of the maturing obligations have been exchanged. This move will go a long way toward lessening the tension in the money market. The Treasury will not do any more new financing until December when a four-month issue will have to be replaced.

A five-year non-callable feature in the trust agreement of Northern States Power Co has been denied by the Federal Power Commission. Company wanted to have it included in the sale of $18 million of bonds at competitive bidding. In denying the request the FPC said the reasons set forth in its order of June 19 to Puget Sound Power & Light Co "are equally applicable here." FPC said in its order that any conclusion that the proposed "non-call" feature would result in a substantial interest saving would involve an evaluation of future market conditions for a minimum five year period, and that "unforeseen circumstances may, of course, result in a substantial alteration of any such evaluation at this time." (See story on page 46 which tells one way of getting around the non-callable clause.)

Utility increases its dividend. Wisconsin Power & Light Co will pay on August 15 a quarterly common stock dividend of 34¢ a share as compared with 32¢ a share in the previous quarter.

"The twin specters of inflation and tight money are haunting the utility market," says The Value Line investment survey released by Arnold Bernhard & Co, Inc. "Specters, uncertain at best, can be exaggerated."

Mid-June drop in prices of electric utility stocks appears to have resulted from investors' fears as to the impact on earnings of sharply higher interest rates and inflation. These are crucial factors, the survey states.

A third influence, the Florida orders to cut rates, proved to be a psychological catalyst that touched off the general price decline, though in itself of little significance.

Examining the probable future impact of high interest rates and inflation, the survey notes:

Utilities are likely to be able to keep pace with inflation, through excellent management, improved equipment, and resulting operating economies. In the postwar years they have done so consistently. In the long run, moreover, inflation also boosts the companies' rate bases.

Average utility can take rising money rates in its stride. Net interest expense of public utilities is still less than 4% of gross revenue, the same proportion as in 1952. Rates for new money tend to fluctuate to extremes. At present relatively high, the average of future rates is likely to be somewhat lower.

Utilities do not carry the same degree of risk as the average run of stocks, says the survey. "Their dividends are safe, their earnings almost recession-proof. They have not been bid up to prices out of line with historic norms of valuation. In a potentially dangerous market of capital gains seekers, the speculative frenzy has passed them by. At present prices, the conservative long-term investor can have more confidence in utilities than in almost any other group," the survey concluded.

RATES

Industry has asked for known rate increases totaling over $60 million since the first of the year. This compared with only $7 million granted for the entire year 1956. The latest company to file for an increase is the Commonwealth Edison Co which is asking the Illinois Commerce Commission to approve rates to

yield $25 million a year, or $11 million after taxes. This is equivalent to 60¢ a share.

Increased costs and the tightness of money were cited as reasons why Montana-Dakota Utilities Co should be allowed to increase rates in eastern Montana, Pres Cecil W. Smith told the PSC in Wolf Point, Mont., recently. The requested increase, he said, would amount to about 3¢ a day for residential consumers and about 12¢ a day for the average commercial consumer.

Texas Baptists seek lower electric rates from 12 utilities. Reason, says Dr W. H. Cook, chairman of the committee and pastor of the First Baptist Church of Nacogdoches: Most companies charge churches on the same demand-load rate as industries. Whereas, he says, churches use electricity to a maximum only on Sundays and week nights when industries are not operating.

SURVEY

Ranking by assets, eight electric utility systems are included in the "first ten" reveals a survey of Fortune magazine. The first ten in order are: American Telephone & Telegraph Co ($16.2 billion); Pacific Gas & Electric Co ($1.98 billion); Consolidated Edison Co of New York ($1.7 billion); Commonwealth Edison Co ($1.35 billion); American Gas & Electric Co ($1.16 billion); Tennessee Gas Transmission Co ($1.0 billion); Public Service Electric & Gas Co ($949 million); Southern California Edison Co ($935 million); Southern Co ($931 million); and Detroit Edison Co ($833 million).

LEGISLATION

Pennsylvania: Gov George Leader vetoes legislation which would have required the state to pay the cost of relocating public utility facilities for federal-aid highway projects. Said Leader: The measure was a "brazen attempt to divert funds constitutionally earmarked for highway improvements to the use of privately-owned and profit-minded utility companies."

EMPLOYEE RELATIONS

Are foremen really on the management team? A recent survey of Personnel Policies for Foremen by the National Foreman's Institute shows:

Foremen in 39% of the firms queried by NFI in 1953 recorded their work time by punching time clocks—a device that traditionally has separated hourly workers from the management group. New study shows that the number of firms that time clock their foremen has dropped to only 17%.

13% of the firms said their foremen in 1953 did not participate in management meetings. Now the figure is down to only 3%.

More than half of the companies gave their foremen no special training whatsoever in 1953. Only 5% of the firms in the 1957 study are in this no-training category.

CO-OPS

A co-op in Burgaw, N. C., has just published a booklet entitled, "Facts About Four County Electric Membership Corp." It gives an idea of how the electrification of the area served by the co-op was accomplished and of the plans for the future. For a copy, write J. J. Malpass, president, Four County Electric Membership Corp, Burgaw, N. C.

MERGERS

New England Electric System simplifies its system. NEES has received Massachusetts Department of Public Utilities approval to merge five of its subsidiaries into a new company to be known as the Merrimack-Essex Electric Co. The five companies to be merged are: Amesbury Electric Light Co, Essex County Electric Co, Haverhill Electric Co, Lawrence Electric Co, and Lowell Electric Light Corp.

4 IN 4

4 orders in 4 years for

Westinghouse gas turbines

as base load units in one station

AS BASE LOAD GENERATING UNITS, an internationally known company installed a Westinghouse gas turbine-generator in 1954, another in '55, another in '56 and a fourth is now on order. These repeat installations are real evidence of reliable performance.

For use in your station . . .

. . . as a base or as an auxiliary power plant, the gas turbine offers you even more than reliability. For example . . .

Capital outlay is far lower than for any other type of turbine and there's no need for steam-generating facilities. Likewise, lower costs for installation, operating labor, maintenance and floor space.

By using the gas turbine exhaust as highly preheated combustion air, for feedwater heating or for generating steam, the overall heat balance of many stations can be greatly improved.

Challenge us to show you how a modern Westinghouse gas turbine might be the most economical solution to demands for greater capacity or increased operating efficiency. Contact your Westinghouse representative, or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

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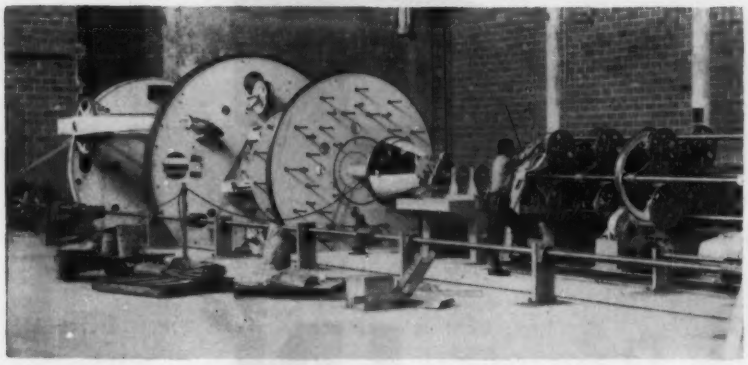

Roebling Adds to Paper Cable Plant

An addition of 32,000 sq ft will be completed soon by John A. Roebling's Sons Corp, Trenton, N. J., on its paper power cable plant.

Included in this addition will be several new machines. A planetary horizontal cabling machine is being installed to accommodate either three or four bobbins (see picture). It will permit manufacture of cables of longer lengths and with three or four conductors. Smaller bobbins are also provided for production of gas-filled paper power cables in low and medium pressure types.

Continuous vulcanization of neoprene protective coverings over lead sheaths will be performed by a new vulcanizing tube. Plans have also been made for additional metallic sheath applying equipment, oil impregnating tanks, and electrical test equipment.

Elliott and Carrier Merge, Effective August 1

Merger terms have been approved by stockholders of Carrier Corp and Elliott Co (EW, April 22, 1957, p 102). Elliott Co, under its present management with Willian A. Elliott continuing as president, will become an operating division of Carrier Corp, at close of business July 31, 1957.

Under the merger terms Elliott stockholders will receive: 65/100 of a share of Carrier common for one of Elliott; 1.2 shares Carrier 4.5% preferred for one of Elliott 5% cumulative preferred; and 1.1 shares carrier 4.8% cumulative second preferred for one of Elliott 5% cumulative second preferred.

A joint announcement by Cloud Wampler, chairman of the board of Carrier, and Elliott who becomes a director and vice-president of Carrier, pointed out that the Syracuse firm is a user of Elliott equipment. Elliott Co produces steam turbines, electrical equipment, and industrial process machinery, and Carrier Corp manufactures air-conditioning equipment for home and industry.

S. M. Smith to Replace Seattle's Diablo Runners

Re-building order for two 144-in. Francis runners from City of Seattle has been received by S. Morgan Smith Co, York, Pa. The over $400,000 order is for Seattle's Diablo Plant on the Skagit River.

Built of a new design, the runners will provide an increase in power of approximately 25% at the same speed, head, and setting. They will develop 115,000 hp each at 171.5 rpm under a rated head of 318 ft.

Shipment of the runners is scheduled for summer of 1958 to utilize the low water period for installation. The units will replace those originally sold by S. Morgan Smith in 1930.

Master Electric Merges With Reliance Electric

Reliance Electric & Engineering Co, Cleveland, and Master Electric Co, Dayton, Ohio, merger has been approved by stockholders of both companies. (EW, May 27, 1957, p 133).

The consolidation will be effected by the exchange of 450,000 shares of Reliance stock for the assets of Master. This is said to be equivalent to 0.67637 shares of Reliance for each share of Master.

Master Electric will be operated as a division of Reliance, under supervision of present management.

Westinghouse to Open Plant in Venezuela

Caracas—(McGraw-Hill World News)—Westinghouse Elec. Corp. is setting up a maintenance and repair shop for heavy equipment at Lake Maracaibo—the company's first plant venture outside the U. S.

The shop is a pilot installation, to be followed by plants in other countries. It will go into operation by the end of the year at Punta Gorda on the eastern shore of Lake Maracaibo, focus of the oil industry in western Venezuela.

The operation is similar to Westinghouse "manufacture and repair" plants scattered across the U. S. It will handle motors and transformers, and will probably assemble panels and other equipment.

Westinghouse operates in Venezuela through a subsidiary, Westinghouse Venezolana, C. A.

Australian Stock Bought

Melbourne, (McGraw-Hill World News)—McGraw Edison Co has bought stock in Tyree Industries Ltd of Australia through its Canadian subsidiary, Canadian Line Materials Ltd. Patents will be purchased from the American company for Australian manufacture of a range of McG-Ed equipment.

(More M & M on page 106)

Tough coverings on Anaconda Heavy Line Wire help solve your primary problem

ANACONDA Heavy Line Wire has been designed to solve your primary distribution problems—with today's higher voltages in mind.

It's made with a tough thermoplastic covering. This covering has high resistance to moisture, weathering and abrasion. It protects conductors from contact with wet and broken limbs—from damage caused by wind, rain, sleet and snow. There's greater freedom from faults, less pruning needed. You save money . . . improve public relations.

Covering consists either of rugged polyethylene or time-tested Anaconda Densheath* vinyl resin compound. Conductors are being supplied in copper, aluminum, and ACSR.

NEW BULLETIN DM-5705 contains full information, including sizes, diameters, etc., plus special sag and tension charts. See your distributor or the Man from Anaconda for free copy. Or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y. *Reg. U. S. Pat. Off. 57418

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SEE THE MAN FROM **ANACONDA®**
FOR HEAVY LINE WIRE

NEW

FAST-APPROACH HYDRAULIC PUMP

For conduit benders
two-speed action
saves time, money

GREENLEE No. 798-SA

The new GREENLEE No. 798-SA Hydraulic Power Pump operates GREENLEE Conduit and Pipe Benders *three to five times faster* than a hand pump. (Teams with other conduit benders, too.) Exclusive GREENLEE fast approach, with automatic change-over to lower speed high-pressure drive, eliminates costly waiting time, makes jobs go faster and easier. Electric motor-driven pump develops 6,000 psi continuous pressure, up to 10,000 psi intermittent. Also speeds work with knockout punch drivers and other hydraulic tools.

GREENLEE *Send coupon*

GREENLEE TOOL CO.
1808 Columbia Ave.
Rockford, Illinois

Please send illustrated Bulletin E-223 on Greenlee No. 798-SA Portable Hydraulic Power Pumps.

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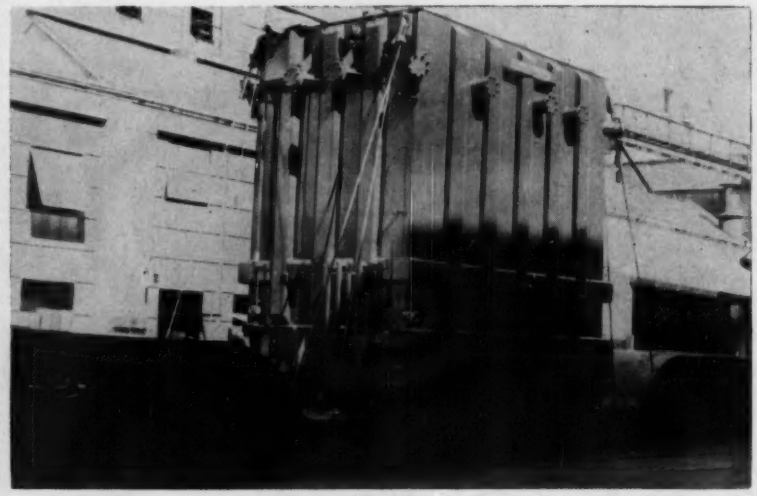


Detroit Ed Gets 360 Mva Transformer

Westinghouse Electric Corp shipped a 360-Mva generator transformer to Detroit Edison's River Rouge Plant.

There the transformer, said to be the largest built, will boost output voltage of a 325,000-kw turbine generator from 17.3 to 129 kv. Shipped in a one-piece tank minus bushings, coolers, and oil, it weighed 340,000 lb. Approximately 24 ft high, 26 ft long, and 17 ft wide, the installed unit weighs 458,000 lb.

Du Mont Eyes ITV Field

Du Mont Laboratories, Inc, Clifton, N. J., has directed its sights in the closed-circuit television field. According to K. F. Petersen, manager of industrial television dept, installed ITV systems utilizing the TC-100 camera are available at about $2,000. Cost of an installed system incorporating the de luxe TC-200 camera equipment, featuring a 3-lb unit measuring 3-in. wide, 3.5 in. high, 10 in. long, is approximately $3,500.

Manufacturers' Earnings

Company	Period	Net Income 1957	Net Income 1956	Earnings Per Common Share 1957	Earnings Per Common Share 1956
Colorado Fuel & Iron	6 Mo June 30	$8,904,714	$8,709,970	$2.55	$2.48
Corning Glass Works	24 Wk June 16	8,288,336	9,354,654	1.22	1.39
Elliott Co	6 Mo June 30	1,021,792	891,145	1.56(a)	1.40(a)
Fairbanks, Morse & Co	6 Mo June 30	1,443,991	1,310,557	1.35(a)	0.96(a)
General Electric Co	6 Mo June 30	127,823,000	112,864,000	1.47	1.30
Gould Nat'l Batteries	Year Apr 30	3,122,100	2,953,740	3.90(a)	3.77(a)
Int'l Business Mach	6 Mo June 30	40,061,507	31,868,620	3.47	3.03(j)
Kaiser Steel Corp	6 Mo June 30	14,908,487	11,736,188	4.24(a)	3.31(a)
Orangeburg Mfg Co	24 Wk June 16	493,832	485,726	1.10(a)	1.14(a)
Porter Co, H. K., Inc	6 Mo June 30	3,460,268	3,991,746	3.21	3.72
Radio Corp	6 Mo June 30	20,311,000	20,037,000	1.35	1.32
Sangamo Electric Co	6 Mo June 30	1,787,000(k)	1,538,000	2.23	1.92
S. Morgan Smith Co	24 Wk June 16	368,421	371,516	0.93	0.94
Union Carbide Corp	6 Mo June 30	69,601,905	72,789,578	2.31	2.42
Worthington Corp	6 Mo June 30	4,868,268	4,529,719	3.10(a)	3.03(a)

Notes—(a) Based on shares outstanding at close of the period. (j) Adjusted to reflect stock split or stock dividends. (k) Net income for the six months ended June 30, 1957, was reduced by non-recurring loss of $109,000 (14 cents per share) after applicable Federal income taxes.

U. S. Primary Aluminum Revealed for Six Months

Total U. S. primary alumium output in the first six months of 1957 was 823,969 tons, according to the Aluminum Association, New York. This was within 4% of the 860,304 tons turned out during the first half of record-breaking 1956. The slight dip was due partly to power shortages resulting from low-water conditions in the Pacific Northwest.

Primary aluminum production for June, 1957, totalled 138,657 tons, according to the Association. This amount is a decrease compared with 144,789 tons in May, and 145,726 tons in June of last year.

U. S. Copper Production

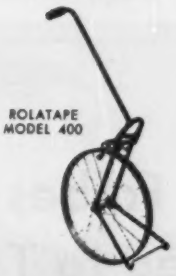
Primary production of copper for June in the U. S. A. decreased 693 tons from the previous month. There were 95,641 tons produced in June, according to the Copper Institute, New York. At the same time refined production decreased from 151,045 tons in May to 134,270 tons for June. Also on the decrease was deliveries to fabricators which dropped 18,343 tons to 101,993 tons. Refined stocks, however, increased 10,184 tons to a June total of 165,549 tons.

M & M BRIEFS

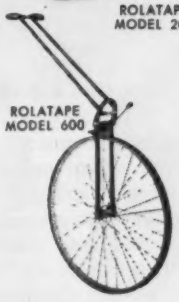
Southern States Equipment Corp, Hampton, Ga., has designed cutouts for universal button head links up through 100-amp, 5-25 kv ratings.

Delta-Star Electric Division, H. K. Porter Company, Inc, has contracted with Fabrica Alcace de Aparelhos Electricos Ltda., for manufacture of Crystal Valve lightning arresters in Brazil. They will also be Delta-Star's sales agents in Brazil for this and other Delta-Star products.

National Electric Products Corp, Pittsburgh, now gives savings on wire and cable costs by using expendable, non-returnable reels on all reels up to and including 30-in. diameter.



ROLATAPE
MODEL 200



ROLATAPE is the Fast, Efficient, Economical, Modern way to measure. Model #400 is widely used by Road Construction Companies, Telephone Companies, Utilities, Sewage Departments and many other industries where measurements are important.

MEASURING time is cut to a fraction with Rolatape. Model #200 is extremely popular with Real Estate Men, Appraisers, Traffic Officers and many others who demand fast, accurate, measurements.

WHEELS on all Rolatapes are precision calibrated, and can be depended upon for long-life service. Model #600 is a special model for long-distance, acreage measuring and for use over rougher terrain.

FOR FAST, ACCURATE measuring—Rolatape Measuring Wheels are the answer. Models #400 and 600 measure distances up to nearly nineteen miles.

MEASURING is simple, time-saving, and efficient when you use a Rolatape. FOR COMPLETE DETAILED ROLATAPE INFORMATION, SEE YOUR DEALER, DISTRIBUTOR, OR WRITE TO:

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UNITED STATES DEPARTMENT OF AGRICULTURE

R.E.A. BULLETIN 161-14

Urges comprehensive tests of automatic oil circuit reclosers, both as routine and post reconditioning checks, in the interest of PERSONNEL SAFETY and adequate, UNINTERRUPTED ELECTRICAL SERVICE to the consumer. (Multi-Amp Catalog 3561 is listed for data on Maintenance of OCR's, etc.)

Utilities EVERYWHERE Use:

MULTI-AMP® TEST UNITS

The only patented instruments made for safe, economical, Fully Automatic LOW VOLTAGE testing of Reclosers and other current-actuated protective devices.

Here's What MULTI-AMP will do:
Accurately test electro-mechanical operation including minimum trip current, operating sequence and coordination with other reclosers and sectionalizers.

Equipment shown is portable MULTI-AMP Model 2040 ACTS, (Arc Current Time Simulator), 4 KVA, 220 V., (440 V. available) 60 Cycle A.C. Fully and automatically tests the four distribution class reclosers in common use: GENERAL ELECTRIC, KEARNY, KYLE and WESTINGHOUSE (Model 2075 Acts can automatically test practically all oil circuit reclosers of both distribution and power class.) FOR ADDITIONAL INFORMATION WRITE FOR DATA SHEET 4755.

MULTI-AMP Corporation
465 Lehigh Ave., P.O. Box 217, Union, N. J.

Write for name of representative nearest you.

CHARLES E. EBLE

Eble, Forbes Elected to Top Con Ed Posts

HARLAND C. FORBES

Charles E. Eble, who started his utility career as an office boy 41 years ago, has been elected president and member of the board of trustees for Consolidated Edison Co of New York, Inc. He succeeds Harland C. Forbes, president since 1955, who is now board chairman.

Eble moves up from his post of vice president in charge of accounting, auditing, and tax operations. He began work for a Con Edison predecessor in 1916 and advanced through various accounting positions. In 1936, when major New York City electric and gas firms merged, he became the present company's senior assistant controller. He was appointed controller in 1946 and was elected vice president in 1953.

Forbes first joined Con Edison in 1924 as assistant to the chief electrical engineer. As system engineer and, later, as assistant vice president of system planning, he guided the company's big post-war expansion. He became executive vice president in 1949.

James F. Fairman, Earl L. Griffith, and L. A. Scofield, vice presidents of the utility company, were named senior vice presidents.

PS of New Jersey Ups Keane

Francis A. Keane, a veteran of 34 years with Public Service Electric & Gas Co, has been elected a vice president and member of the board of directors. He fills the vacancy caused by Thomas N. McCarter's resignation because of ill health.

An engineer with a master's degree in business administration, Keane has held various positions in the statistical and controller's departments since starting with the New Jersey utility in 1923. He was appointed assistant to Pres Donald C. Luce in 1955.

Keane, a graduate of New York University, is active on the Summit, N. J. planning board.

McCarter served as director since 1943 and vice president since 1939. He is the son of the late Thomas N. McCarter, who was Public Service Co's first president.

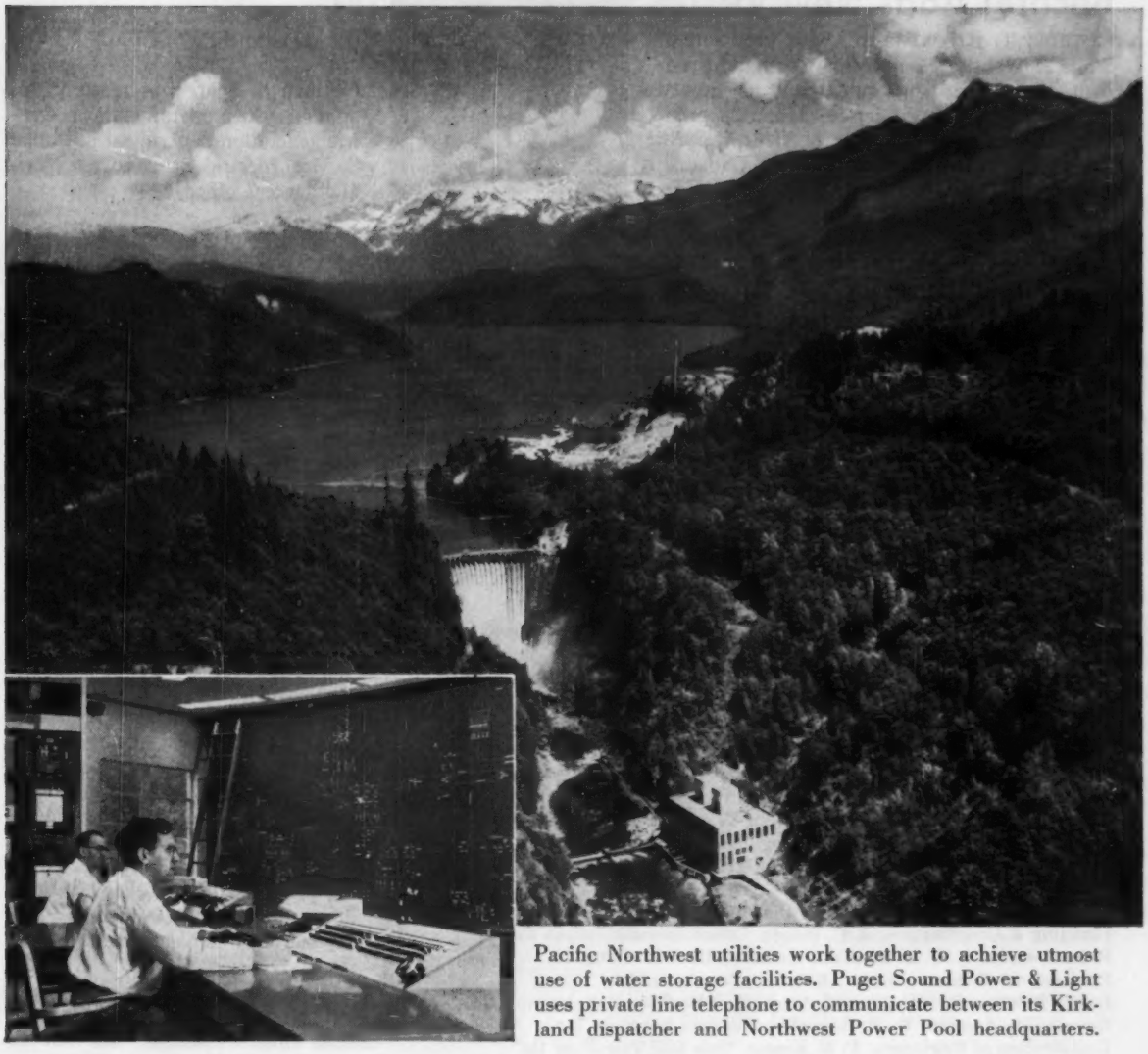
FRANCIS A. KEANE

Delta-Star Names Killian Vice President

Delta-Star Electric Division of H. K. Porter Co, Inc, has promoted Stanley C. Killian to vice president. He joined the division upon graduation from University of Michigan, became chief engineer in 1944 and assistant general manager in 1954.

Killian holds numerous patents on switchgear and switch contact designs.

S. C. KILLIAN



Pacific Northwest utilities work together to achieve utmost use of water storage facilities. Puget Sound Power & Light uses private line telephone to communicate between its Kirkland dispatcher and Northwest Power Pool headquarters.

Puget's dispatcher arranges power transfers by fast, reliable private line telephone

When Puget Sound Power & Light's dispatcher has power to spare—or when he wants to borrow some from his neighbors, he uses a private line telephone to make the arrangements.

Bell System private lines connect his operations center at Kirkland, Wash., with Northwest Power Pool headquarters at Spokane. Many Washington and other Northwest utilities are members of the pool.

Puget's dispatchers call hourly to report their demand, output and excess energy. This co-operation insures that all the region's power is utilized to make more low-cost energy available to people.

Efficient operation, smooth co-operation — both require dependable communications to keep costs down. Call your Bell Telephone Company business office, and our representative will be glad to help you study your requirements at no cost to you.

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PRIVATE LINE TELEPHONE • PRIVATE LINE TELETYPEWRITER • DATA TRANSMISSION SYSTEMS
CHANNELS FOR: REMOTE METERING AND CONTROL • TELEPHOTOGRAPH • CLOSED CIRCUIT TV

Bechtel Adds New VP

Alfred T. Krook, former vice president of Stone & Webster Engineering Corp and president of its Canadian counterpart, has joined Bechtel Corp, San Francisco, as a vice president. He will hold the title of vice president in Bechtel International Corp and Canadian Bechtel, Ltd.

A. T. KROOK

AIEE Units Get New Chairmen

The new chairman of departments and general committees of American Institute of Electrical Engineers for 1957-58 have been appointed by Pres Walter J. Barrett. The department chairmen are:

Administration—**Walter B. Morton,** Pennsylvania Power & Light
Admission & Advancement—**J. L. Callahan,** RCA Laboratories
Professional Development & Recognition—**R. A. Heising,** Summit, N. J.
Publications—**L. R. Gaty,** Philalelphia Electric Co
Technical Operations—**Hendley Blackmon,** Westinghouse Electric

The committee chairmen are:
Executive: **W. J. Barrett,** New Jersey Bell Telephone Co
Board of Examiners: **R. F. Brower,** Consolidated Edison Co
Constitution & By-Laws: **R. E. Kistler,** Pacific Telephone & Telegraph Co
Edison Medal: **E. B. Robertson,** Dallas, Tex.
Education: **Eric Walker,** Pennsylvania State University
Educational Publications: **E. W. Boehne,** Massachusetts Institute of Technology
Finance: **C. H. Linder,** General Electric Co
Fortescue Fellowship: **J. E. Calvert,** University of Pittsburgh
Lamme Medal: **H. I. Romnes,** American Telephone & Telegraph Co
Management: **H. B. Kiphuth,** Westinghouse
Members-for-Life Fund: **K. L. Wildes,** MIT
Membership: **H. R. Heckendorn,** Western Electric Co
Periodicals & Transactions: **W. F. Denkhaus,** Bell Telephone Co of Pa.
Planning & Coordination: **J. C. Woods,** Commonwealth Edison Co
Prize Awards: **B. G. A. Strotzki,** McGraw-Hill Publishing Co
Professional Conduct: **H. A. Affel,** Bell Telephone Labs
Public Relations: **J. A. Parrott,** American Telephone & Telegraph Co
Recognition Awards: **W. R. Brownlee,** Southern Services, Inc
Registration of Engineers: **F. H. Knapp,** Ohio Bell Telephone Co
Research: **J. S. Oldacre,** Stanford Research Institute
Safety: **H. H. Watson,** GE
Sections: **H. H. Sheppard,** Rumsey Electric Co
Special Publications: **C. E. Dean,** Hazeltine Research Corp
Standards: **W. A. Lewis, Jr,** Illinois Institute of Technology
Student Branches: **J. W. Rittenhouse,** High Voltage Equipment Co
Surveys: **F. C. Roberts,** GE
Transfers: **Charles Concordia,** GE
Volta Scholarship Trustees: **Harold S. Osborne,** Upper Montclair, N. J.

PERSONAL BRIEFS

At Wisconsin Public Service Co, **R. B. Fick** has become industrial development coordinator, a new post; **R. W. Kunkel** is new industrial sales representative at Wausau; **K. P. Sweet** is industrial sales representative at Oshkosh; and **E. A. LeBoeuf** has a similar post at Green Bay.

At Niagara Mohawk Power Co, **W. Scott Hayward** has been advanced to operations supervisor of the maintenance and operation of stations in the Salmon River district and all activities of the Pulaski electric department.

Norman S. Spatz was recently appointed system operation of the electric generation department at Public Service Electric & Gas Co's Newark general office.

Retirement of **Frank G. Neale, Jr,** as vice president and purchasing consultant has been announced by the American Gas & Electric Service Corp.

Robert C. Birkes, an electrical engineer with Pacific Power & Light Co, is a new member of the Oregon board of engineering examiners.

At General Electric Co **Willard L. Male** has been named manager of methods and time standards development for the firm's manufacturing services . . . **Walter J. Campbell** has been designated consultant-management training at GE's advanced management school . . . The chemical materials department has named **T. C. Chart** general manager of its insulating materials section . . . New manager of engineering training and education in GE's engineering services is **M. Wilson Sims** . . . GE employees recently elected to membership in Controllers Institute of America were **Howard A. Van Wyngarden,** manager-finance, Supply Co Division; **Merritt A. Gambill,** finance manager, high voltage switchgear dept; **R. Kenneth Geisert,** finance manager, low voltage switchgear dept; and **William L. Pultz,** finance manager, medium voltage switchgear dept.

Westinghouse Electric Corp has made the following appointments: **Dr. W. H. Brandt,** as director of advanced systems engineering, Sunnyvale Manufacturing Division; **Francis E. Davison,** as assistant to the vice president of the Steam Division; **H. Thompson Duff** as budget administrator; and **Robert M. Harris** as sales manager of the miniature lamp department . . . At the East Springfield appliance plant, **O. H. Yoxsimer** has been made plant manager with responsibility for operations including engineering, production and sales. **H. F. Hildreth** is his assistant and **H. R. Bryant** administrative assistant.

MEETINGS CALENDAR

AUGUST

Western Electronic Show and Convention—Annual Meeting, Cow Palace, San Francisco, Calif., August 20-23.

Electric Companies Advertising Program—Copy Group Meeting, Seaview Country Club, Absecon, N. J., Aug. 22.

American Institute of Electrical Engineers—Pacific General Meeting, Pasco, Washington, Aug. 28-30.

SEPTEMBER

American Institute of Electrical Engineers—2nd Special Technical Conference and Exhibit on Magnetic Amplifiers, Hotel Penn Sheraton, Pittsburgh, Pennsylvania, September 4-6; Sixth Annual Industrial Electronics Symposium, co-sponsored with Institute of Radio Engineers, Morrison Hotel, Chicago, Ill., Sept. 24-25.

Instrument Society of America — 12th Annual Instrument Automation Conference and Exhibit, Cleveland Auditorium, Cleveland, Ohio, Sept. 9-13.

Illuminating Engineering Society—National Technical Conference, Biltmore Hotel, Atlanta, Ga., Sept. 9-13.

Electric Companies Public Information Program—Steering Committee, New York City, Sept. 11; Workshop Conference, Whittier Hotel, Detroit, Mich., Sept. 25-27.

Edison Electric Institute—Industrial Power & Heating Group, Van Curler Hotel, Schenectady, N. Y., Sept. 11-13; Accounting Division Organization Meeting, jointly with AGA, Lemington Hotel, Minneapolis, Minn., Sept. 19-20; Industrial Relations 10th Annual Round Table Conference, Drake Hotel, Chicago, Ill., Sept. 23-25; Meter & Service Committee, Hotel Nicolet, Minneapolis, Sept. 23-25, Electrical Systems and Equipment Committee, Cosmopolitan Hotel, Denver, Colo., Sept. 30-Oct. 1.

Maryland Utilities Association—33rd Annual Fall Conference, Cavalier Hotel, Virginia Beach, Va., Sept. 13-14.

Southeastern Electric Exchange—Engineering & Operation Section, Biltmore Hotel, Atlanta, Ga., Sept. 19-20.

Public Utilities Association of the Virginias—39th Annual Meeting, White Sulphur Springs, West Virginia, Sept. 19-21.

Missouri Valley Electric Association—Accounting Conference, President Hotel, Kansas City, Mo., Sept. 23-24.

American Society of Mechanical Engineers—Fall Meeting, Statler Hotel, Hartford, Conn., Sept. 23-25.

Electric Companies Advertising Program—Copy Group Meeting, Detroit, Mich., Sept. 25.

OCTOBER

Pennsylvania Electric Association—50th Annual Meeting, Bellevue-Stratford Hotel, Philadelphia, Pa., Oct. 2-3.

Indiana Electric Association—French Lick-Sheraton Hotel, French Lick, Ind., Oct. 2-4.

Missouri Valley Electric Association—Sales & Rural Conference, Lassen Hotel, Wichita, Kansas, Oct. 2-4.

International Association of Electrical Leagues—Annual Conference, Sheraton-Gibson Hotel, Cincinnati, Ohio, October 2-5.

National Industrial Conference Board—Atomic Energy Course for Management, Hotel Moraine on the Lake, Highland Park, Ill., Oct. 6-12.

Iowa Utilities Association—Management Conference, Hotel Fort Des Moines, Des Moines, Iowa, Oct. 7-8.

Edison Electric Institute—Prime Movers Committee, Hotel New Yorker, New York City, Oct. 7-9; Area Development Workshop, Phoenix Hotel, Lexington, Ky., Oct. 9-11; Transmission & Distribution Committee, Statler Hotel, Boston, Massachusetts, October 17-18; Accounting Division Taxation Accounting Committee, held jointly with AGA, Williamsburg, Virginia, Oct. 23-25.

American Society of Mechanical Engineers—Lubrication Conference, sponsored jointly with American Society of Lubrication Engineers, Royal York Hotel, Toronto, Canada, Oct. 7-9; Power Conference, American Hotel, Allentown, Pennsylvania, Oct. 21-23.

National Electronics Conference, Inc—13th Annual Meeting, Hotel Sherman, Chicago, Ill., Oct. 7-9.

American Institute of Electrical Engineers—Fall General Meeting, Morrison Hotel, Chicago, Ill, October 7-11; Computers in Control Symposium, Hotel Claridge, Atlantic City, N. J., Oct. 16-18.

Southeastern Electric Exchange — Accounting Section, Fort Sumter Hotel, Charleston, S. C., Oct. 10-11; Sales Section, Tutwiler Hotel, Birmingham, Ala., Oct. 16-18.

Rocky Mountain Electric League—54th Annual Convention, Broadmoor Hotel, Colorado Springs, Colo., Oct. 13-17.

Interstate Power Club—Hotel Martinique, New York City, N. Y., Oct. 14.

Oklahoma Utilities Association — Electric Light and Power Division, Woodward, Okla., Oct. 25; Eastern District, Bartlesville, Okla., Oct. 25.

Atomic Industrial Forum—Annual Conference, New York City, Oct. 28-30.

American Nuclear Society—Winter Meeting, New York City, Oct. 28-30.

National Association of Railroad Utilities Commissioners—Annual Conference, Peabody Hotel, Memphis, Tennessee, October 28-31.

Industrial Management Society—21st Anniversary Industrial and Management Clinic, Hotel Sherman, Chicago, Ill., Oct. 30-Nov. 1.

Institute of Radio Engineers—3rd Annual Technical Conference of the Professional Group on Electron Devices, Shoreham Hotel, Washington, D. C., Oct. 31-Nov. 1.

NOVEMBER

Edison Electric Institute — Accident Prevention Committee, Penn-Sheraton Hotel, Pittsburgh, Pa., Nov. 6-8.

Pacific Coast Electrical Association — Hawaiian Conference, Reef Hotel, Honolulu, Hawaii, Nov. 7-8.

Institute of Radio Engineers—Third Annual Instrumentation Conference, Atlanta Biltmore Hotel, Atlanta, Georgia, Nov. 11-13.

National Electrical Manufacturers Association—Traymore Hotel, Atlantic City, N. J., Nov. 11-15.

Electric Companies Public Information Program—Inter-Regional Committee, Mayflower Hotel, Washington, D. C., Nov. 19.

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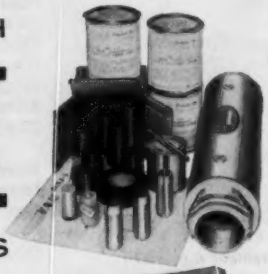

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READERS FORUM

Pres Roach Takes Issue

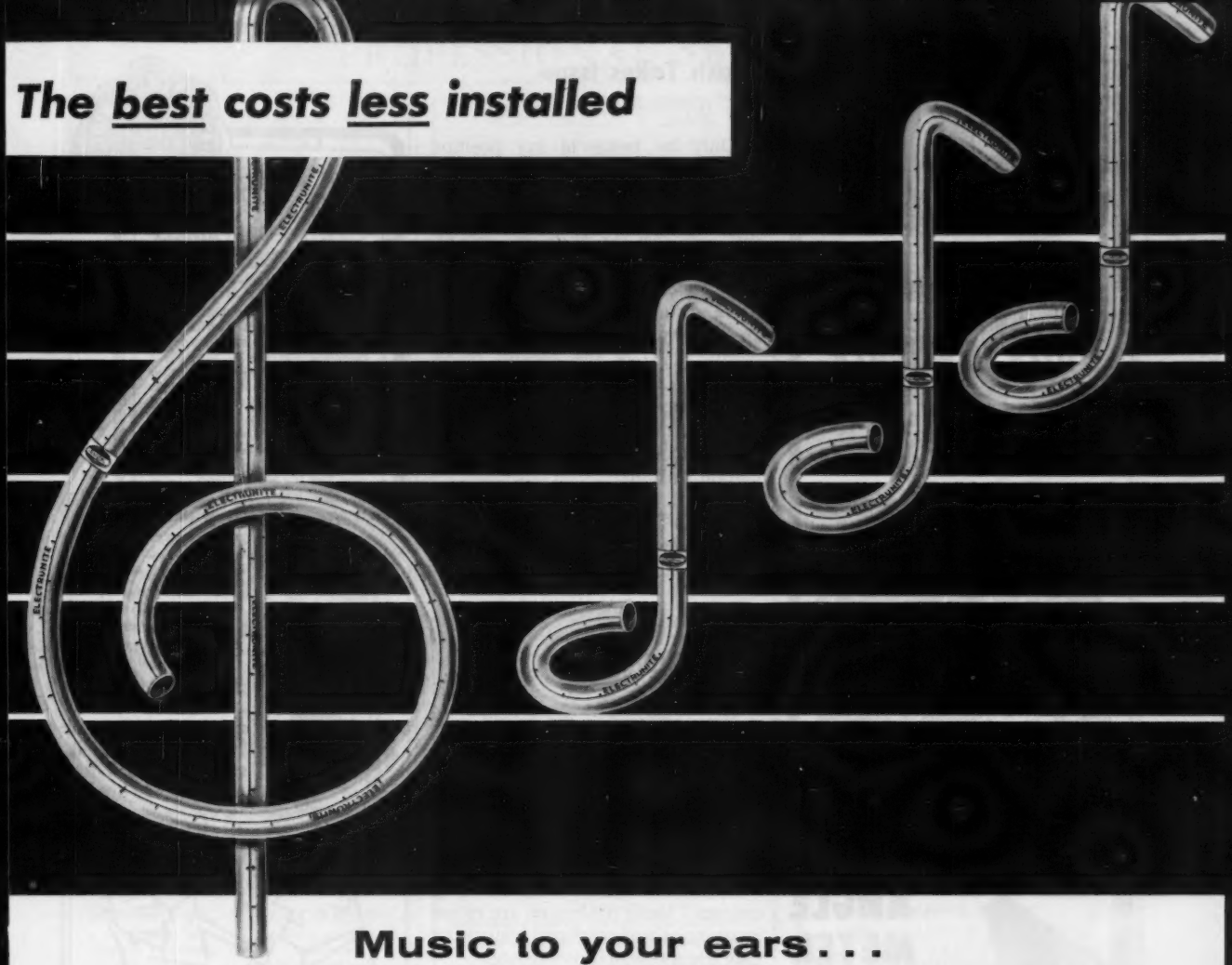
To the Editor:

I assume from your July 1 story on the tax amortization matter that your office did not have available to it the transcript of my testimony before the Kefauver Committee. In that hearing we strongly emphasized our disagreement with the assumption that the federal government actually had to or in fact did make public borrowings in substitution of temporary tax payment deferrals or for reductions in taxes resulting from any of the allowable personal or business deductions in the Internal Revenue Act.

However, if for the purpose of calculations you accepted such an assumption,—which, of course, we did not,—then the maximum gross cost to the government would be at a simple interest rate; but beyond that, if you assumed, as was done by our opponents, that the government borrowed the money at 3¼%, then those taxpayers from whom the money was borrowed would have to pay income taxes on the interest received by them. If you assumed these taxpayers on the average would fall into the 50% tax bracket, then the federal government would get back 50% of the gross cost, which I estimated at $16,000,000, and therefore the net cost to the federal government would be only $8,000,000. I then stressed that in this same period of time the benefits flowing to federal and state governments from our construction would total $565,000,000.

As the victims of the confusion, distortion, and even downright dishonesty, we know only too well from bitter experience that a casual general news treatment, which touches the high spots and then only in an incomplete fashion, will not clear up the misunderstanding. A pro-and-con statement of conflicting claims produces no answers. It is a topic which for the welfare of the industry requires a positive approach in both language and figures that completely refutes the results of the unsound assumptions whether they are made by the public power group or by Mr Rainwater.

(Continued on page 114)



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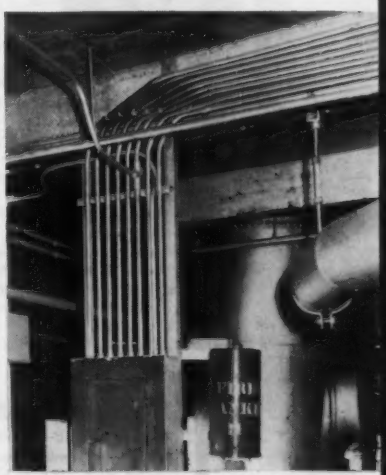
Utilities have found that Republic ELECTRUNITE® E.M.T. hits the high note of electrical conduit economy in original installation costs and over-the-years service. They specify Republic ELECTRUNITE E.M.T. because they save important installation time and operation dollars!

Republic ELECTRUNITE E.M.T. goes in fast, goes in to stay, provides trouble-free raceway protection for years and years . . . whether the conduit is exposed or imbedded in concrete. And, Republic E.M.T. is particularly recommended for concrete installations.

Republic ELECTRUNITE E.M.T. is "INCH-MARKED" for fast, accurate measuring. Just cut to the desired length with no muss, no fuss. And it features exclusive "GUIDE-LINE" from end-to-end to help keep bends in the same plane, avoid costly delays, wasted time, and wasted material. There's no kinking, no wrinkling.

The use of compression-type couplings and connectors speeds installation, too; means no threads to cut, no runs to turn. And since the tightly adhering galvanized seal remains unbroken, you get maximum protection against corrosion.

It will pay you to check into the important cost-saving advantages of Republic ELECTRUNITE E.M.T. It's produced to A.S.A. Specification C.80.3 and Federal Specification WW-T-806, latest revisions, and carries the Underwriters' Laboratories Seal of Inspection. For additional information, send for your copy of 84-page ELECTRUNITE bending instruction booklet. Write today, it is free.



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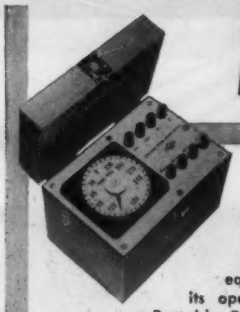

Completely self-contained, and requiring no auxiliary equipment for its operation, this Portable Phase Angle Meter offers a direct way of checking relay and instrument connections, particularly directional over-current relays, differential relays or similar equipment. It may also be used to measure the prevailing power factor in each phase of a polyphase watthour meter installation. The device has a frequency of 60 cycle, with voltage ranges of 60, 120 and 240 volt. Current ranges are 1, 2.5 and 5 amp. . . . DIMENSIONS: 9½ x 6¾ x 5⅝ inches. Weight 19 pounds.

Also available in other voltage combinations

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EASTERN SPECIALTY CO.
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Roach Takes Issue

(Continued from page 112)

Only by being in my position could you, I am sure, understand my continuing irritation over the use of the expression "fast write-offs" or "fast tax write-offs" by responsible news and editorial people, who should know better and be more accurate in the use of words. In the first place, it is grossly inaccurate; and, in the second place, it simply adopts a word gimmick originating with the public power crowd to cast reflection upon a perfectly proper and legitimate depreciation formula.

Tom E. Roach
President

Idaho Power Co
Boise, Idaho

Mea Culpa, Mea Culpa

To the Editor:

Your editorial in the July 8 issue quoting an allegory about a "monk who staked his all" is highly offensive and objectionable to at least one of your readers.

If, as stated, this so-called allegory is "popular among professors of undergraduate philosophy courses," these professors are either ignorant of true medieval history; or they are motivated by bigotry!

Frank I. Morgan

808 Race Ave
Lancaster, Pa.

POWER BRIEFS

Los Angeles Dept of Water & Power is now using its new $81-million, 512 Mw steam plant in Sun Valley. An eight-day open house followed dedication . . . **Virginia Electric & Power Co** has an official OK for construction of a $1.8-million addition to its Gilmerton station. This is the initial step toward a $22-million expansion of the 200-Mw plant.

Dayton Power & Light has chosen a site for its third station—capacity expected to be more than 1,000 Mw . . . **Delaware Power & Light Co** is erecting a 150-Mw unit at its Edge Moor station.

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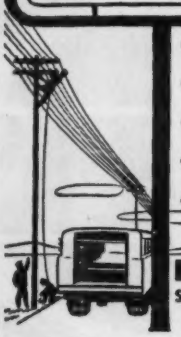

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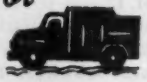
When busy engineers and executives in the dynamic electric power industry get around to naming the one magazine they find most useful in their work, it's ELECTRICAL WORLD, by a margin of 4 to 1. Year after year, survey after survey, WORLD earns *at least* four times as many votes as any other magazine in the field.

Whether a Winch *Line Hook or a complete Line Body check your requirements with*



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Advertising in This Issue

Allis-Chalmers Mfg. Co. ...2nd Cover
8, 9, 34, 35, 74, 75
American Telephone & Telegraph Co. 109
Anaconda Wire & Cable Co..... 105

Bartlett Tree Experts..... 98
Bechtel Corp. 73
Bethlehem Steel Co. 17
Blackburn Corp., Jasper..... 16
Burndy Corporation 30

Cole Electric Co..... 118
Continental-Diamond Fibre Sub. Budd Company 87

Directory of Engineers..... 115

Eastern Specialty Co..... 114
Electric Service Works, Delta-Star Electric Division, H. K. Porter Co., Inc. 82
Electroline Company 10
Elliott Company 15
Engineers, Directory of..... 115
Erico Products, Inc..... 86
Everstick Anchor Co..... 76

Federal Pacific Electric Co..3rd Cover
Foushee & Heckendorn 112

General Cable Corp..... 38
General Electric Co.
Apparatus Dept. 65, 67, 117
Silicone Products Dept..... 14
Globe Company 84
Greenlee Tool Co..... 106

Homelite Div., Textron Inc..... 39
Hubbard & Company..... 36

I-T-E Circuit Breaker Co., Switchgear Div. 18
Indiana Steel & Wire Co., Inc... 114

Kaiser Engineers Div. Henry J. Kaiser Co. 97
Kearney Corp., James R. 90, 91
Kellogg Co., The M. W. 93
Kidde & Co., Inc., Walter 12, 13
Kuhlman Electric Co.....4th Cover

Leach Corp., Inet-Palmer Div.... 92
Line Material Industries..... 40

Mallory & Co., Inc., P. R..... 25
Minerallac Electric Co..... 112
Minnesota Mining & Mfg. Co.... 81
Moloney Electric Co.....26, 27
Multi-Amp Corp. 107

Nelson Electric Mfg. Co..... 96

Ohio Brass Co.....23, 24
Okonite Co., The..... 4

PLM Products, Inc..... 112
Penn-Union Electric Corp..... 71
Pennsylvania Transformer Div., McGraw-Edison Co. 11

RT&E Corp. 85
Republic Steel, Steel & Tubes Div.113
Roebling's Sons Corp., John A... 69
Rolatape, Inc. 107
Ryerson & Son Inc., Joseph T... 114

S&C Electric Co. 6, 7
Sangamo Electric Co..... 31
Searchlight Section 116
Simplex Wire & Cable Co..... 77

Utility Tool & Body Co..... 114

Wagner Electric Corp.....32, 33
Westinghouse Electric Corp..28, 29
37, 78, 79, 88, 89, 94, 95, 103

■

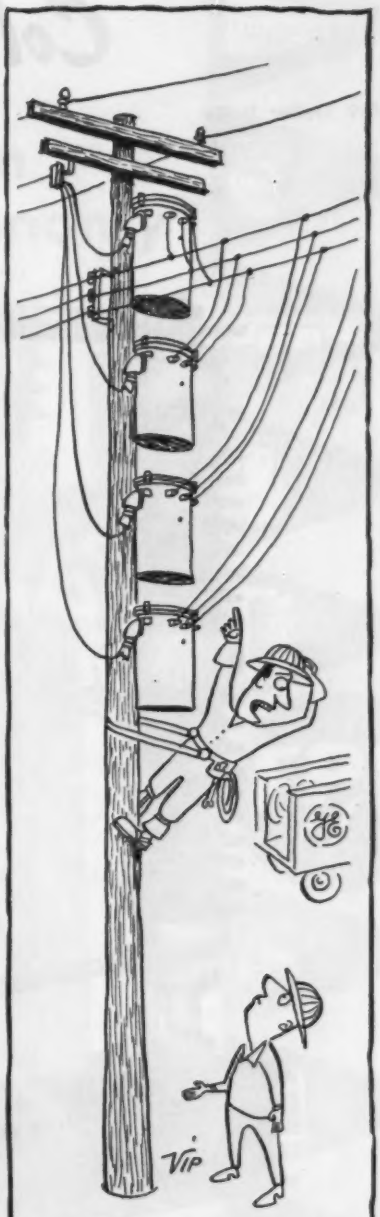
PROFESSIONAL SERVICES 115

■

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES..... 116

EQUIPMENT
(Used or Surplus New)
For Sale 116



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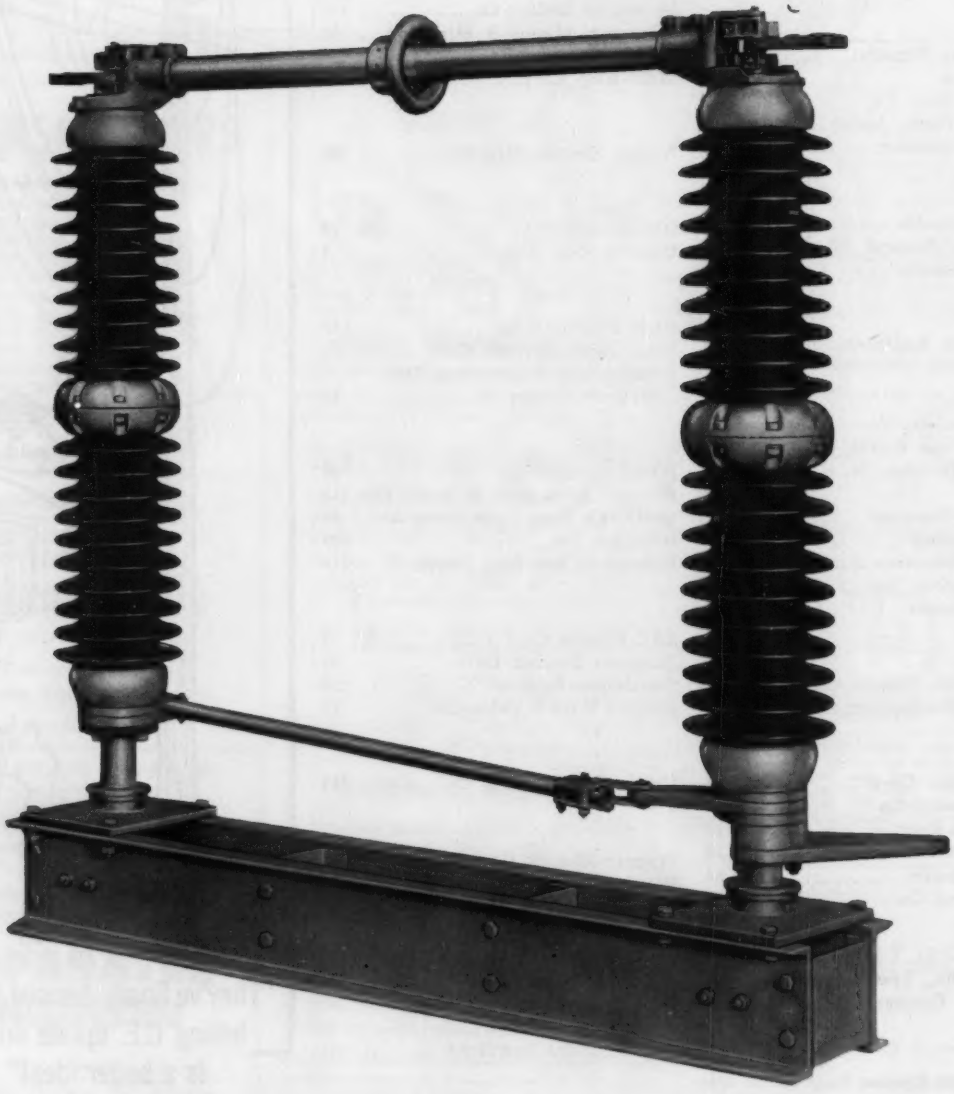

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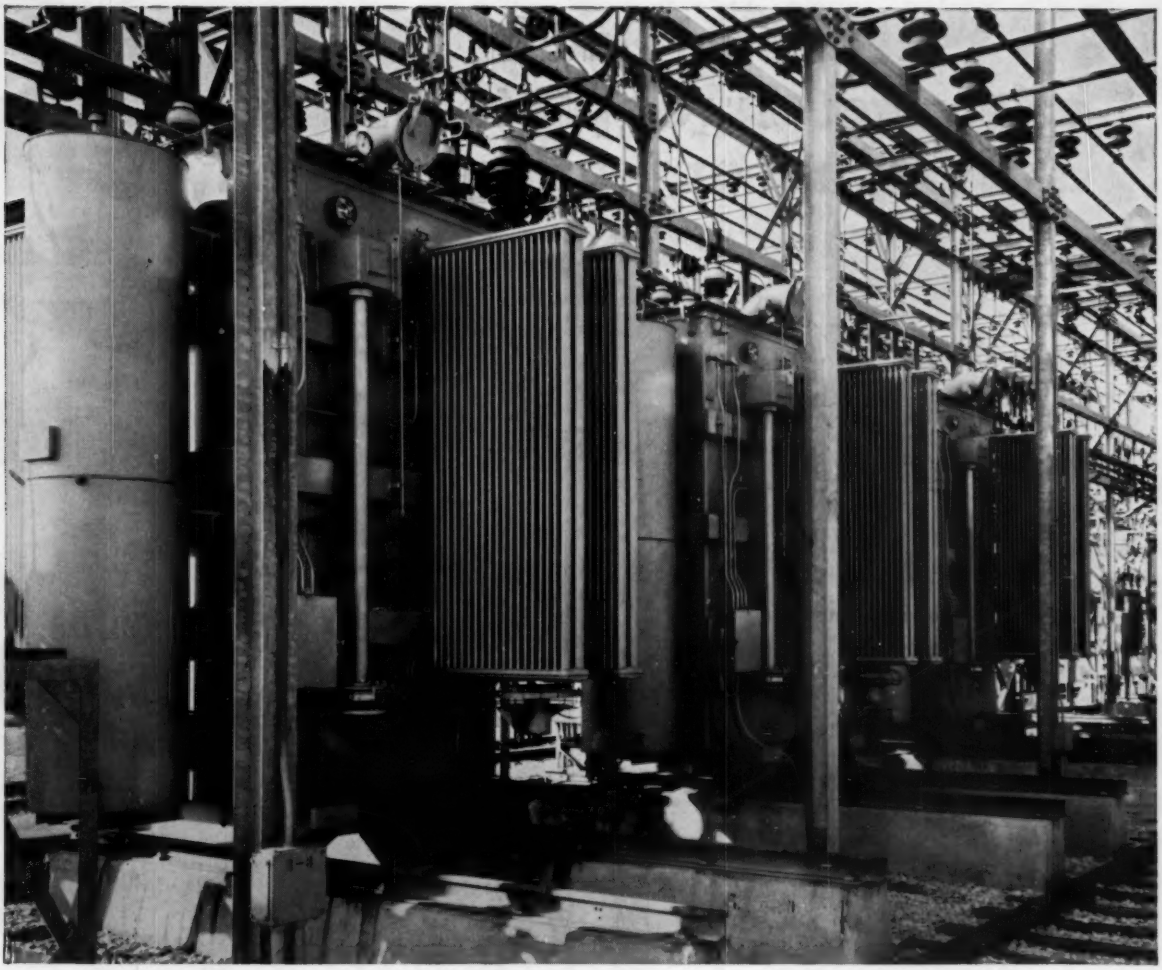

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